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THE SOCIETY is the growth of over forty years of achievement and leadership. Its members are engineers and technicians skilled in every branch of motion-picture film production and use, in television, and in the many related arts and sciences. Through the Society they are able to contribute effectively to the technical advance of their industry. The Society was founded in 1916 as the Society of Motion Picture Engineers and was renamed in 1950.

Membership in Sustaining, Active, Associate or Student grades is open to any interested person according to his qualifications. Information about membership, technical activities and standards and test films for the industry is available from Society Headquarters.

SOCIETY OF MOTION PICTURE AND TELEVISION ENGINEERS

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Views on Our Engineering Field

By JOHN G. FRAYNE, *SMPTE President*

THE previous convention of the Society in Los Angeles was held just two years ago; and the one before that, in April 1953. We all recall the record attendance of more than 1300 at the 1953 meeting and the intense interest generated then in technological developments. At that time 3-D was going strong, stereophonic sound had just been introduced and anamorphotic cinematography was being seriously proposed.

The October 1954 convention came after the demise of 3-D, but when there was great interest in the use of wide films and giant screens. It was also a time when stereophonic sound was apparently widely entrenched, anamorphotic photography had been widely accepted, and the technological future looked bright.

But what is the technological situation in the industry as we meet here today? First of all, interest in experimenting with radically new motion-picture systems appears to be waning. Instead this seems to be a period of critical evaluation of the many innovations of the past three years. There is ample evidence of a tendency to reduce the number of different types of prints for the theater. We hear of black-and-white pictures with monaural sound replacing color pictures with 4-track magnetic sound. In addition, some of the new systems under discussion two years ago have not yet shown the progress anticipated. And the few new systems that are functioning provide product for only a minor fraction of the motion-picture screens of the world. The salvage value of many of these new proposals has been discovered *a posteriori* to be in the effectiveness of the larger negative area available in the camera with resulting higher picture definition on the 35mm print.

These conclusions have been reached, however, only after the expenditure of large sums of money to develop the necessary accessory equipments and to carry on the extensive testing programs associated with each system.

It appears, therefore, as we meet for the 80th convention of the SMPTE, that the industry is showing less interest in developing new wide-film and wide-screen systems. It is tending instead to re-emphasize the standard 35mm medium with whatever embellishments can be retained without adding materially to the ultimate print and projection costs.

Presented at the Get-Together Luncheon on October 8, 1956, at the Society's Convention at Los Angeles.

Now we may ask: what has brought about the apparent decline and fall of this brave new world of the motion picture industry. There are many contributory causes including several outside the engineering sphere. The first is probably more economical than technological. The increased costs of production and distribution of the many versions of prints demanded by the specialized processes have proved to be an almost insuperable burden to the producing studios. The resulting confusion and the increased cost to the theater owner to provide equipment to play any and all of the films offered to him have proved to be a powerful deterrent to their general adoption. One can imagine, for example, the reaction of a theater owner to playing 35mm, 55mm and 70mm in a single booth, with the added complexity of 4-track and 6-track magnetic stereo, optical and Perspecta sound, plus screen aspect ratios varying all the way from the old standard 1.33 up to a maximum of 2.55.

However, an equally important reason for the present need to pause and take stock lies in our hasty departure from a long adopted standard to a multiplicity of practices, set, in many cases, by arbitrary unilateral action. It seems, in retrospect, that the engineers and executives of the industry should have evaluated the long-range effects more carefully before introducing each of these new techniques. An effort should have been made to determine the value of each and every innovation with an eye toward eliminating those which could offer only a degree of current sensationalism, and which would serve only to inhibit and delay the orderly progress of the industry.

Technological progress is essential to the vigorous growth and healthy development of any industry. However, its effects can be weakened by failure to recognize the broad economic realities of the situation, and the far-reaching effects of technological developments on all phases of the industry. I have a few suggestions to offer which I believe to be of value.

First, it is my opinion that engineering should have a greater voice and influence in studio management circles. This might prevent the hasty adoption of new and untried ideas without first subjecting them to rigorous test and field trial.

Second, studios should encourage and extend the practice of having a competent and experienced motion-

picture engineer direct and coordinate all technical developments in each of the major motion-picture studios. Assisted by a capable staff, he should be responsible for the development and testing of all new, integrated motion-picture systems that cut across all lines of motion-picture technology regardless of rigid departmental boundaries.

The motion-picture industry has, with a few exceptions, been notably lacking in giving wholehearted support to this kind of activity, instead relying too heavily on the equipment suppliers to provide the necessary engineering know-how. The efforts of suppliers should be supplemented by the studios if a coordinated engineering program is to result. In these days of accelerated technological progress, the industry must take advantage of every development that will strengthen its competitive status in the world entertainment market.

Finally, engineering in the motion-picture studios should be divorced from the opportunism and expediency that govern the conduct of many of our studios in their continued search for new and novel means of entertaining the public.

In conclusion, let me say that the industry has reached an important stage in its advance where it must now carefully evaluate and fully digest the many innovations of the past few years. The motion-picture industry must and will resume the path of technological progress that has brought it from the flickers of the nickelodeon to the almost perfect reproduction accomplished in today's magnificent productions. This Society stands ready now, as it has always from its founding, to aid the industry with all the means at its command in its search for improved means of presenting its product to audiences throughout the world.

Looking to the Future in Sound

By LOREN L. RYDER

Automation is being applied in many fields of manufacturing and production. It can help us in the art of sound recording for motion pictures and television. In this paper the writer explains a simplified system of automation and discusses the transition from the old to the new.

Many people fear progress. If they do not fear it openly, they fear it unconsciously. Instinctively they oppose everything new. They oppose automation, even though most people do not know what it is. They think it is an automatic device that puts people out of work. Nothing could be more untrue.

Actually, automation is accomplished through the addition of memory devices and the feedback of intelligence to control automatic machines.

Most of these memory devices use magnetic recording and they use the feedback principle which was first introduced in our audio amplifiers. Even though we use these devices every day, we in sound recording are in one of the last industries to take advantage of automation.

For years we have talked about automatic dubbing. The new word for it is "automation dubbing." It is a device that remembers what was done during the first rehearsal and feeds this information back during the second and subsequent rehearsals, so as the work progresses it is only necessary to make corrections to that which has already been done.

At Paramount we have such a device working. It is a prototype and at present is used on only one channel or dial. We shall expand it to work on all dials. In our system we mix or change the volume of a control tone, from an oscillator, which is simultaneously recorded and used to control a variable-gain amplifier. The variable gain amplifier varies the volume of the reproduced sound. When the oscillator tone is reproduced during the second rehearsal it activates the variable-gain amplifier and repeats the sound expression of the first rehearsal.

During the second rehearsal the sound expression can be further changed as the control tone passes through the mixer dial on its way from the reproducer to the variable-gain amplifier. The modified control tone is recorded simultaneously with the second rehearsal. This process is repeated through the third, fourth and subsequent rehearsals, except that the control soundtracks are alternately erased and re-used. The system that we are using is not unique and as time goes on, better systems will probably be developed. We hope that the information we have gained will prove of value to others.

The sound heard during each rehearsal and the sound that is finally composited is always reproduced from the original soundtracks. It is only the control tone that goes into multiple generations of recording. Different frequencies can be used for different dials, thus many dials can be controlled by one control soundtrack and it is possible to record three to six sound tracks on a single piece of film. All of our variable equalizers are in effect controlled by attenuation, so that they, too, can be handled by this device.

Automation dubbing is very helpful in progressively gaining the desired overall sound effectiveness. It makes it possible to use the desired features of the best rehearsal. We are no longer dependent upon the memory and dexterity of men to repeat that which they have done before. At the same time our experience indicates that wherever corrections are to be made, there is a tendency to compound these corrections.

As an example — an actor may start a line low and raise his voice; the production mixer hears the low voice and raises the volume, but his reaction time is such that he has not corrected the first word or two. During the first dubbing rehearsal, the dubbing mixer hears the low line and raises the volume. The thrice corrected volume is now twice too high. If the dubbing mixer corrects this situation through the automation control, he must anticipate the low line and then do reverse dialing to compensate for the double correction. In this situation it is far easier to return to and correct the

Presented on October 10, 1956, at the Society's Convention at Los Angeles, by Loren L. Ryder, Paramount Pictures Corp., 5451 Marathon St., Hollywood 38.
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original recording. In our automation dubbing the mixer operator is able to return instantaneously to the original reproduction, thus simplifying the problem of correction.

The magnetic film used for recording the control tracks is tested for uniformity throughout its length and from roll to roll. Differences in reproduced level will compound errors and cause trouble.

In our automation dubbing channel, we are also providing for fast and automatic rewinding, plus automatic resynchronization for all soundtracks. After the film has been threaded on the machines, it is never touched by human hands. The equipment is started by the dubbing mixer, who also stops the equipment at the end of his review or earlier if he desires. Instantaneously and automatically all of the machines rewind and resynchronize, ready for the next rehearsal or take.

The advantage of this system is not in a reduction of personnel but rather a better utilization of their skills. The mechanics of dubbing mixing and the cue catching are done by the machine. This eases the burden on the dubbing operator and makes it possible for him to concentrate on the dramatics and sound effectiveness of the work that he is doing.

Future Applications

In my opinion automation should not be limited to the rerecording channel. We should find other uses; we should have a device to control artistry and expression; we should be able to correct the sound expression so that the best picture take also has the expression of the best soundtrack.

Some four or five years ago we spent many thousands of dollars on automatic and pre-set lighting. We started to use this equipment on 2-kw lamps (2,000-w lamps). When wide screens and high keylighting replaced our 2-K's with 10-K's (10,000-w lamps), the program was dropped. With the new memory devices and feedback of intelligence, someone is going to accomplish that which we endeavored to do.

The industry has so complicated theater projection that even the most alert and conscientious projectionist finds himself in trouble at times. His projector is a maze of gadgets. The time has arrived when some manufacturer should make an integrated projector — one unit that can go in a booth in front of a port and project a picture. In fact, in this modern age it would be quite simple to have a clock start the projector in the morning and turn it off at night. Automation can do all of the rewinding, lens changing, focusing and volume adjustment even better and simpler than man. It should not replace the man but it should ease his burden and simplify his tasks. It would be an error to imply that no automation is being used by the film industry. The laboratories have used memory devices for some years for the control of printer lights and they have used feedback of intelligence for the control of film processing.

Now a word about the fear of new inventions and the fear of automation. If you will take a look at industry, you will find expanding employment goes hand in hand with expanding scientific development — whereas there is diminishing employment in stagnant organizations. When the writer first introduced magnetic recording in the motion-picture industry, the soundmen and their union were very concerned about unemployment due to simplification. Actually, the simplification of magnetic recording is the very factor that has expanded its use in television and motion pictures, as well as broadcast and record making. There are three or four times as many men employed today as were employed when we used the optical method of sound recording.

I assure you, that if we can effect further simplification, we shall expand our horizon and create even more employment.

Discussion

Fred R. Wilson (Samuel Goldwyn Studios, North Hollywood, Calif.): In view of the latest developments in sound such as stereophonic recordings losing favor with the exhibitors and passing over other technological methods at our disposal to improve the quality of sound it seems to me that the only future progress is in a method or means of producing sound more cheaply. What is your opinion as to the future for an improved sound for the theater?

Mr. Ryder: I think your question is well in order and I shall endeavor to guess with you. I am sure that audiences are not as conscious of technical improvements and quality as we wish that they were. As far as we technicians are concerned, there is quite a difference between magnetic recording and optical recording. Unfortunately, the audiences are not conscious of this difference, but what they are conscious of is how the sound is used. This is the phase of sound wórk that contributes to dramatic expression—the feeling and entertainment of motion pictures. My discussion of automation as applied to sound dubbing was directed toward gaining this desired improvement in dramatic expression and gaining it by a method which should cost less.

I can assure you that machine-automation cannot produce dramatic expression. We will always be dependent upon men, and in this case dubbing mixers, to provide feeling in sound handling. The machine will only lessen the mechanical burden and simplify the task of the man.

In discussing sound expression, please understand that I am not talking about overdoing sound. I am talking about the type of thing that makes sound flow and makes it seem natural to the scene. At times it should be spectacular, but for the most part the audience should not be conscious of the existence of sound.

You have asked a question in regard to stereophonic sound. In my opinion there are two things which have been wrong with this process—first, the cost has been too great and, secondly, stereophonic sound handling either limits or accentuates editing. Editing in motion pictures is used as a system of gaining story progression and a good editor is the man who can edit the picture in a manner so that the audience is not conscious of the cuts. In my opinion the use of stereophonic sound as it has been handled, largely tends to punctuate the cuts—it tends to emphasize the very thing that the experienced editor is trying to eliminate. No one can stand here and make a generalized statement, because there are many people who have used stereophonic sound who are just as conscious of this problem as I am. Some of these people have done an excellent job of minimizing the punctuation of cutting; but this is one of the reasons, in addition to the economic reason, that we at Paramount have not used stereophonic sound.

Technical Opportunities in the 16mm and 8mm Fields

By JOHN A. MAURER

In view of the fact that many in this audience are friends of long standing, I trust that I will be forgiven for an informal way of presenting some of the results of my thinking about the 16mm industry over a period of several years during which it was necessary for me to work in another field, that of aerial photography.

What I am going to present is not, in the proper sense, a technical paper. Nevertheless I shall refer to the results of certain research work that was carried on during this period with the help of some of my associates. The statements I shall make may often be surprising to you. Since I am not in a position to document them properly at the present time, I suggest that you simply take them on faith, with the understanding that I intend to publish the results of my work as soon as I am again in a position to give a complete treatment and a proper demonstration.

Films

In order to have motion pictures we usually start with film. Many years ago the 16mm motion picture became practical for widespread amateur use for the first time because we had reversal film and the reversal method of processing. We tried, for a long time subsequently, to get away from the reversal process, and many people who are producing 16mm motion pictures today feel that they have done so successfully. My purpose in referring to film is to register my conviction that in 16mm production it is not necessary or advisable to get away from the reversal process, but, on the contrary, we ought to cultivate that process and try to get the greatest benefit from its favorable possibilities.

Some of the new films that have appeared and are going to appear on the market will add considerably to the practical usefulness of this kind of film. The new Kodachrome duplicating stock (Type 5269) has been, I think, rather a revelation to those who have had a chance to work with it at its best. The improvement in sharpness is quite outstanding. The improvement in color fidelity under these circumstances seems to me even more impressive.

In photography on black-and-white reversal films we shall soon have the alternatives of much greater speed without sacrifice of the quality that has been available, or of substantially improved quality at the film speed to which we have been accustomed. As I see it, we should choose the latter whenever possible. A new reversal printing stock with improved characteristics is also shortly to be made available.

The Reaction of the User to 16mm Professional Film Production

This seems a good place to refer to the kind of evaluation I have heard expressed many times when I have talked with people who are not connected with the 16mm industry but who are users of its products or are in some way exposed to its end results. This judgment is quite different from that of experienced workers in the industry, who are likely to feel that a great deal of progress has been made and that the present result is technically satisfactory.

When films of the present general level of quality are shown to people who are not active in this field, the members of the audience, if they comment at all, are likely to express themselves as did the Vice President of one of our great universities. He said, "We use 16mm movies in many phases of our work, and I sit and watch them from time to time. I think that you who are enthusiastic about 16mm ought to keep in mind that the people who see 16mm films also go to the theater and watch the pictures and listen to the sound. They are used to seeing a good clear picture and listening to good clear sound. In 16mm the picture often is not very clear and the sound sometimes is difficult to understand. This does not make a good impression. What you need is to improve the quality of your product."

I have believed for a long time, and I have taken other opportunities of saying, that we can never afford to be complacent about the quality of the results now obtained with 16mm films and equipment. With the proper techniques, with competent camera and film laboratory work, with a good projector and someone who knows how to use it, we can put on a good show, provided we do not attempt to do it in a location which has the acoustical properties of an empty warehouse or the dimensions of the Seventh Regiment Armory. The average performance, however, justifies the reaction expressed by my university friend. Much of what I have to say is concerned with why this happens.

Disadvantages of the Negative-Positive Process

Up to the present time we have had only reversal color stocks for use in 16mm cameras. Color negative and positive print stocks are promised, but it is my belief that they will not prove to be unmixed blessings for this medium.

In black-and-white work it is natural that many producers have felt that since the 35mm industry uses negative-positive, this must be the only right way to do the job.

In 16mm, however, the result is a somewhat grainy image that is likely to be full of white marks that continually flash on the screen. Furthermore, printed splice marks are always conspicuous, whereas splices made in reversal originals are rarely noticeable when the print is projected. Add to these defects the somewhat inexpert sound recording that often goes with 16mm productions, and further add mediocre projection, and we have an end result that is not likely to make a good impression on any audience.

It is true that, if we study sensitometric curves, we find that negative-positive procedures should give better tone reproduction than the reversal films that have been in use for the past several years. This I have always attributed to the fact that reversal films have been manufactured primarily for amateur use, and, as is well known, amateur taste tends to prefer rather contrasty results. It is certainly possible to manufacture reversal stocks that have long tone scales and soft contrast; I can remember several that were formerly on the market but were withdrawn because they were not purchased in sufficient quantities by the amateurs. The new black-and-white reversal stocks to which I referred earlier tend in this direction, since they are intended for professional use.

Even if it should continue necessary to control contrast primarily by the lighting of the subject in order to obtain pleasing tone rendition on reversal stocks, in my opinion it would still be worth while, because, when reversal stocks are used properly, the final result on the screen is far more pleasing than any that I have seen resulting from the use of negative-positive.

It is to be hoped that the industry will manage before too long to provide reversal processing facilities for black-

Revised with some additions from the record of a talk before the Society's Northeastern Section at Rochester, N.Y., on April 18, 1956, by John A. Maurer, JM Developments, Inc., 116–118 W. 29th St., New York 1.
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and-white film that will operate under exact control. At the present time, as many of you are aware, one of the factors that deters producers from using black-and-white reversal films is the difficulty of obtaining consistent processing.

16mm Cameras

Frame Line Disagreement

One of the seemingly trivial matters that has always been a serious problem for the 16mm producer is a result of the fact that many of the cameras that are in use remain essentially amateur cameras. The amateur as a rule has one camera. He makes movies with it. All the films come from the same source, they are all spliced together, and everything is just fine. The professional has a camera with two or more magazines, or he uses two or more cameras, and his frame lines on different scenes have a way of not matching. For over twenty years this problem has existed, and still nothing effective has been done about it.

An obvious idea would be to provide some sort of adjustment to alter slightly the distance between intermittent and aperture. Of course, this should not be too easily accessible and, once made, should be capable of being locked permanently in place. In this way, separate cameras or separate magazines could be adjusted to frameline uniformity.

There might be several approaches. One would be to standardize the location of the pulldown claw in the camera with reference to the aperture. Several excellent proposals of this kind have been made in the committee work of the Society. Another approach, which is probably more practical, would be to make it possible for all professionals to use a professional type of camera. However, there are not too many such cameras in existence, and unfortunately the size of the market for professional equipment makes it impossible to mass-produce it. It is to be regretted that no one has ever managed to design a professional camera that could be partially mass-produced, thus bringing the cost to a point that would be attractive to advanced amateurs as well as to professionals. I believe that enough amateurs would buy such a camera to provide the necessary manufacturing volume.

Amateur and Professional Cameras

The amateur camera, logically, uses a mechanism that is suitable for mass production. If the design is right and if the film is right, the accuracy of registration is satisfactory.

It is a fact that film today is perforated with very high accuracy. The equipment and control methods that are used to keep perforation accuracy what it should be are carefully maintained. There is no question that film is now perforated with much greater accuracy than in the past; in fact, with accuracy greater than that of most of the equipment on which it is likely to be used.

This leads me to believe that a camera using some of the designs, and perhaps some of the same parts that go into the amateur camera, while embodying the essential refinements of the professional camera, would be a possibility, and would give a product that could be manufactured in reasonable quantity.

It may be worth while to list what I consider the essential refinements that distinguish the professional from the amateur camera. Aside from an accurately controlled frame line, they are:

(1) An accurate finder, adjustable for parallax and capable of showing the exact fields of lenses ranging from 15mm to 100mm in focal length.

(2) An accurate means of focusing.

(3) Film capacity of at least 400 ft.

(4) A quiet-running motor drive.

(5) Construction sturdy enough to give reasonable life in daily use.

Film Processing

One of the problems that has plagued the 16mm film industry ever since it graduated from a purely amateur status to a professional one is film processing. It is impossible to produce a film of good quality with uncontrolled or improper film processing, yet even today, after more than twenty years of professional 16mm production, it is not uncommon to see and hear prints that contain clear internal evidence of poor handling in the laboratory. For example, at a large meeting which I attended recently, several of the "outstanding" films which were projected had soundtracks, in some cases reduced from 35mm, in which the tonal quality immediately betrayed the fact that proper sensitometric control had not been exercised.

Only last week, one of the producers in the New York area came to see me in order to ask: "What do I do? I've tried this, that, and the other laboratory, and while I get excellent sound at times, I can't seem to get *consistently* good sound." Unfortunately I could not give him a satisfactory answer.

The fact is simply that not enough film laboratory men and not enough of their customers have an adequate appreciation of the importance of accurate control in printing and processing. "Gamma" and "density" to them are merely words; they have not learned what they mean in terms of picture and soundtrack quality. Because of this, they tolerate departures from the proper values which do not even require laboratory measuring instruments to detect them; they are evident immediately to the eye and ear of anyone who is technically competent. The remedy for this state of affairs is education, but in this case, who is to do the educating?

Film-Laboratory Equipment

I happen to know a good many things about the 16mm film laboratory industry, and it is my opinion that many of the 16mm laboratories are quite a few years behind the times in their technical development. For example, very few have adopted spray processing, although this type of equipment has been known and used successfully for at least fifteen years, and it has been generally recognized that it gives results of a more consistent quality than can be obtained in any other way.

Another example of what seems to me to be a lack of technical progressiveness is the almost universal use of continuous sprocket-type printers. I wonder how many of you have ever made prints from sharp 16mm originals on a good step printer and also on a good continuous printer and then screened the prints side by side on matched projectors. I've done it repeatedly because I was connected with a film laboratory in which we started out to use only step picture printers. Because of a sudden major increase in the volume of black-and-white printing, we found it necessary to use continuous printers, and we tried very hard to get them to turn out prints of the quality we had been getting from the step printers. While the results were satisfactory to the trade, I want to say that no matter how much work was done to get the continuous printers into a state of good adjustment, in these side-by-side projection tests one could identify the product of the step printer immediately because of its greater sharpness and appearance of clarity.

Nevertheless, the trend in the industry today is definitely away from step printers if we can say that step printers ever were used to any significant extent. Something ought to be done about this, and I intend to try. I believe it is possible to develop a step printer that will compare in rate of production and convenience of operation with the continuous machines in use today.

We have also the problem of the optical printer. Anyone who wants to produce films in the 16mm size generally comes to a point at which he complains loudly that "It's just too bad you can't get optical effects in 16mm." This problem has now been solved at least partially by the technique of "A and B roll printing," in which scene No. 1 is on roll A, scene No. 2 on roll B, scene No. 3 on roll A again, and so on, with black leader in each roll to match each scene that is in the other roll. With a step printing machine equipped to make a complete light change between two frames of film, and also equipped to produce fades, the "A and B roll" technique makes it possible to provide fades, dissolves, and the simpler kinds of wipes in the laboratory, but it is a cumbersome procedure.

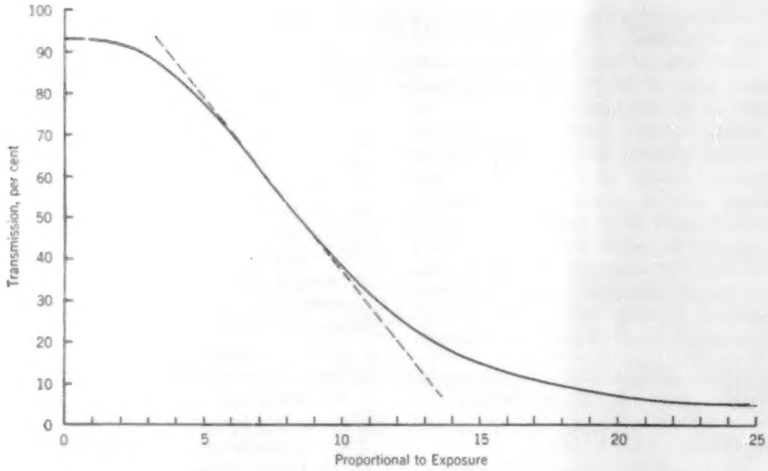

Figure 1.

Perhaps before it is too late, someone will get around to providing good optical effect printers, and also production optical printers on which it will be possible to turn out prints that always have the standard emulsion position, and on which it will also be possible to correct the wandering frame lines to which I have already referred.

Most of the soundtracks in the 16mm industry are still printed on continuous sprocket-type printers of the same basic type that is in use throughout the 35mm industry. A printer which drives the two films past the printing aperture by means of continuously running sprocket teeth cannot, except under highly unusual conditions, produce an optimum print. This was demonstrated by the Bell Telephone Laboratories as long ago as 1930. It was demonstrated again in a paper which I presented to the Society in 1948. It was proved a third time at the Lake Placid convention in 1950 by Dr. Frayne. These demonstrations have not had any appreciable effect on the printing practice in the industry.

I have built optical soundtrack printers which have done a noticeably better job, and these printers have been in commercial use for nine years and have been well publicized. Recently one of the laboratories in Hollywood has made it known that it has built printers to operate on the same principles. This is progress, although at a rather moderate rate.

Electrical Sound "Printing"

In the meantime, we have had another development which has been used commercially in both Hollywood and New York. That is the printing of release soundtracks by re-recording from magnetic masters.

There has been much discussion in the trade, although not very much in print, about how this should be done; whether in variable area or in variable density, and about the merits of some of the devices that have been applied to improve the end result. Here there is room for much difference of opinion. What I am about to say is based on several years of experimental work followed by three years of commercial operation in the production of "kinescope" release prints.

An electrical print is necessarily a "direct positive" soundtrack. Variable-area direct positives must be exposed and developed to produce densities within a rather narrow range if they are to be free from cross modulation distortion, which usually manifests itself as a distortion of the sibilant sounds in speech. When the film in use is fine-grain positive print stock such as must be used for black-and-white picture release prints, this density range is approximately from 0.6 to 0.7, which is much lower than has been found suitable for ordinary soundtrack prints. This low density of the dark part of the track makes noise reduction ineffective, so that prints made in this way have objectionably high levels of background noise.

One corrective method that has been proposed is to introduce electrically in the re-recording a rectified signal proportional to the envelope of the modulation, polarized in the right direction to cancel the "envelope" distortion that is produced when the track is made dense enough to have acceptably low background noise. Unfortunately that is not the whole story of cross modulation. I shall not go into the details, on which I could easily spend another hour, but I do want to state that I do not believe that entirely satisfactory variable-area, direct-positive soundtracks will be obtained by an electrical compensating method that attempts to simulate cross-modulation distortion.

This is something on which I have done a great deal of work. Much more remains to be done before the results will be complete enough for publication. I can only hope that I will have an opportunity to complete this particular piece of research. However, for what it is worth, I may say that one result of the study is that after having manufactured and sold variable-area sound recorders for twenty years, I have now, in my own thinking, switched over completely to the variable-density system.

In working with variable density I have adopted a very simple idea that was invented, according to the records of the British Patent Office, about 1920. It is, one would think, an extremely obvious idea. When light is impressed on film the result, after the film has been processed, is a reduction of light transmission which is not a linear function of the exposure. I am not now referring to the usual "H and D" curve, in which both the exposure and the resultant blackening of the film are plotted on logarithmic scales. I am referring to a plot of exposure versus the resultant light transmission on linear scales (Fig. 1). Given a curve of this kind one can determine a nonlinear characteristic of exposure versus electrical input which will result in a transmission curve that is linearly related to the electrical input. At the meeting at Lake Placid in October 1950, I demonstrated some films made in this way, and also showed a slide of Fig. 2, which is one form of optical system that can be used to obtain fully controlled nonlinear light modulation. (This paper, unfortunately, was never written out for publication.)

This system of variable-density recording with controlled nonlinear modulation can be worked out to produce a negative that will give an undistorted print, or it can be worked out to produce an original "direct-positive" track that plays without distortion. It can also be worked out to produce a direct playback track by the reversal process. In any of these cases the final result is a soundtrack that plays with substantially the output level of good variable-area recording, while in all other respects the sound is superior. When we make a direct-positive track on fine-grain positive film we obtain a signal-to-noise ratio, on a good reproducer, of 48 to 50 db; with reversal film the signal-to noise ratio is even higher, so that the final signal-to-noise ratio, at the present time, is determined by the playback system rather than by the film.

These soundtracks seem to be inherently free from any tendency to produce the distorted sibilant sounds that have troubled the industry so much in the past. They also have excellent frequency characteristics. On black-and-white film I have worked with a frequency range flat to 9000 cycles

(down 6 db at 12,000), using a maximum of 10 db of high-frequency equalization. On color reversal printing stock of the type now being discontinued I have obtained a characteristic flat to 6000 cycles (down 6 db at 7500 cycles).

Much work remains to be done on this method of recording. For example, it appears likely that a better noise reduction technique can be worked out, since these records have much more than the usual modulation capability when biased for the usual 12 to 15 db of noise reduction. This should make it possible to operate with less "margin" than we have been accustomed to use in the past, and also with longer "attack" times. Both of these changes would tend to reduce the audibility of effects associated with the use of noise reduction, such as "thumps" and "hush-hush."

The work I have been describing has made it possible to produce 16mm soundtracks that do not, of course, fully come up to the standards of "high fidelity" as that term is defined today, but which come close enough so that most listeners would hardly perceive the difference. Does this do us any good?

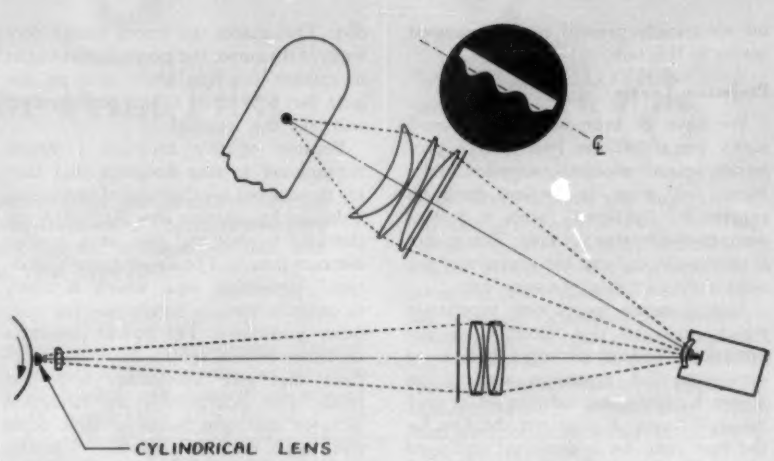

Fig. 2. Optical system for variable-density recording with controlled nonlinearity.

The dark circle in this figure shows the mask that is inserted next to the condenser lens system on the side toward the galvanometer. If this mask were a simple triangle or a series of saw teeth with straight sides, the modulation would be a linear change of intensity as the galvanometer mirror swings about an axis perpendicular to the plane of the drawing. The light is integrated into a line image uniformly bright along its length because the objective lens is cylindrical; there is nothing to image the structure of the mask on the film. A pre-calculated curvature of the contour of the mask can give to the system whatever nonlinearity is necessary to produce the results described in the paper.

16mm Projectors

At the present time it does us a great deal of good if the user happens to reproduce the film on a Kodak Model 25 projector. It does some good if he uses one of the so-called "JAN-Spec" projectors, which are manufactured for the Armed Services. With most of the other machines on the market the benefit is not very great because the limitations of quality are not in the film but in the projector. It does little good to have 9000 cycles on the film if the projector sound system cuts off at 4500 to 5500 cycles. It does little good to have a signal-to-noise ratio of 50 to 55 db. if the projector has a noise level 35 to 40 db below the average level of sound reproduction. However, we shall certainly never get projectors of higher performance if we do not have superior film to play on them.

In the industry today there are about fifty men who were members of the committee that wrote the specifications for the military model, or "JAN-Spec" projector, during World War II. I am sure they will remember that when requirements were proposed that were considerably better than could be met by any of the projectors than in existence there were many who were ready to say, "No, this is unreasonable; this can't be done." Nevertheless there were always others who were prepared to prove that individual requirements could be met, so that after much discussion many of these advanced requirements were embodied in the specification as "targets." Almost all of these "target" requirements were exceeded in the machine that was finally developed.

Unfortunately the projector industry in general has not raised its standards to the level of the "JAN-Spec" projector. There are a number of reasons for this. To illustrate one of them, anyone who opens the lamphouse of the "JAN-Spec" projector will find in it a condenser lens system that looks enormous when compared with the system in most other projectors.

Because it has this large and well-designed condenser the JAN-Spec projector delivers to the screen approximately twice as much light as any other portable machine on the American market.

Without going into an exhaustive analysis of the optics, it may be said that one cannot do with the small diameter system what can be done with the big one. The difficulty in introducing this improvement in other projectors is that in most cases condensing lenses as large as those used in the JAN-Spec machine cannot be installed because they interfere with essential mechanical parts. Therefore each machine would have to be fundamentally redesigned in order to increase the light output to the level of the JAN-Spec machine. Such a redesign is costly, and, something which is even more discouraging to a manufacturer, it requires a further large expenditure for retooling. I personally believe that these expenditures would be rapidly recovered because of increased sales, but this is a commercial judgment which each manufacturer must make for himself.

On the other hand, it would not be difficult and would not cost much to improve the sound reproduction of most of the machines now on the market. The sound optical system, which in most cases delivers a line of light 0.75 mil in width, can easily be redesigned to give a 0.5-mil image, and this does not necessarily make it more costly. Redesign of the amplifier to use present circuit developments and some of the newer tube types would probably result in simplification at the same time that the frequency range is extended and distortion and microphonic pickup reduced.

It is believed by some engineers that an extension of the frequency range would prove undesirable because it would make the noise and distortion of many of the older soundtracks unpleasantly audible. On the basis of much experience I do not believe that this would be the case. It is true, unfortunately, that some bad 16mm soundtracks are still being circulated by film libraries, but I have almost always found that, in reproducing such films, the greater intelligibility that results from wider range reproduction more than offsets the disagreeable effects of noise and distortion, so that the wider range is preferred if the listener can make a comparison. At the same time a machine equipped to reproduce the frequency range up to 6500 or 7000 cycles is capable of bringing out the superior qualities of soundtracks having this range, which have been reaching the market in substantial quantities for at least ten years, as well as the still far greater realism of

the electrically printed tracks discussed earlier in this talk.

Projection Lenses

We have all been aware for a good many years that the Petzval-type projection lenses customarily supplied in the 16mm field were, as the lens designers express it, "afflicted" with a serious amount of curvature of field. This makes it impossible to focus the center and the sides of the picture at the same time.

I shall never forget one experience which brought this forcibly to my attention. I had photographed some very beautiful mountain scenery on 16mm Kodachrome, using a set of very "sharp" lenses. I projected the film for the first time on a projector equipped with a lens of the usual type. The effect on the screen was literally unendurable; the films contained an abundance of fine detail in all parts of the picture, and the contrast between the parts that were in focus and those that were not was startling. If an attempt was made to compromise the focus between the center and the corners of the frame the result was a sharply focused ring, with both the inside and the outside blurred.

If this effect is not usually seen in so objectionable a way it is because most images, after printing, do not contain this amount of extremely sharp detail. As we improve our techniques for carrying really sharp images through to the release print the defects of the present projection lenses will become more and more noticeable. The average audience has by now grown used to looking at a 16mm screen picture and, while the audience is vaguely uneasy and aware that something is lacking, this lack is not really defined until the same audience has an opportunity to see a good, sharp original shown on the screen by a really good optical system. When this happens, "the scales fall from their eyes" and they see the light. Never again will they be satisfied with things as they were.

Fortunately one manufacturer has made a serious effort to improve the moderate-priced projection lens. The "field flattener" is a great improvement, but it brings one operating difficulty. Because the field flattener is very close to the film, it is difficult to keep it free from oil and dirt; in fact, the use of a brush, which is often required to get lint out of the gate, frequently results in getting the back of the lens smeared with dirt. This makes the screen image very foggy. Of course, the projectionist ought to remove the lens when cleaning the gate, but how many 16mm projectionists will take this trouble?

Because of this situation I would recommend to lens designers that they try to work out another way of producing a flat-field projection lens that will leave the lens nearest the film at a greater distance from it. The six-element "Gauss-type" projection lens, which is costly to manufacture, is surely not the only other possibility. The patent literature on lenses reveals several other constructions that give adequately large flat fields with extremely sharp definition at large apertures. Some of these types have been used as projection lenses in Europe.

Comparison of Progress in the Motion-Picture and Electronic Arts

We have arrived at a point where we are capable of doing much more with nontheatrical films than we are doing commercially. The question arises: How far ahead should we look?

If we compare the state of the radio art twenty-five years ago with radio and television today we see that there have been far-reaching changes. If we compare the sound motion picture of that period with what we have today we see much improvement in the details of motion-picture production, but otherwise no changes comparable to those in the electronic arts. It might be said that we had at the start of the twenty-five year period a product that was more nearly mature than the product of the electronic industry. I hardly think that that is correct. In my opinion the difference is due to the fact that somehow the people in the electronic field have had a greater impulse to change, to experiment, and develop new techniques and new products. In this respect I believe that the photographic field has not made the most of its opportunities. It seems to me that we ought to look ahead and plan boldly, not thinking first in terms of what we know is *possible* but first in terms of what is *desirable*. If we know that some result is desirable we can usually find out how to accomplish it.

Possibilities of 8mm Film

As one example of what I mean I'd like to talk briefly about the 8 mm film in relation to education. The picture quality obtained in recent years with 8 mm film, in original reversal, of course, compares acceptably with the average quality of 16 mm prints. Pictures large enough for average classroom use can be projected. What is needed to make the 8 mm film suitable for a wide range of educational uses is a soundtrack.

We have had one projector marketed for a short time in this country which used 8 mm film with a magnetic stripe, but I am not referring to this. The magnetic stripe does not solve the problem completely because it adds expense. I am talking about 8 mm photographic soundtrack. This is by no means as impossible as it sounds.

Not many people are aware of the fact that quite good sound can be reproduced from very narrow photographic tracks. I know that this is true because I have experimented with tracks as narrow as 2 mils wide on special fine-grain film. In this audience there is at least one man who heard these records on several occasions, and can confirm that they were comparable in quality of reproduction with 78-rpm disc records.

On 8 mm film it will not be necessary to go to such an extremely narrow soundtrack; one 0.015 in. wide should serve nicely. If the film is run at 24 frames/sec and if the sound is applied by the electrical printing method I have described, on the basis of present knowledge, we can expect to obtain a 5000-cycle frequency range and a signal-to-noise ratio of 35 to 40 db. This is as good a performance as most users are getting from 16 mm sound equipment today. Is it not reasonable to expect that if a really determined attack were made on this problem, including the development of new film stocks especially designed for the printing of fine detail in both picture and sound, we would do still better? It seems to me that such 8mm sound films would find many applications in industry as well as in education.

In concluding this talk, I want to emphasize that I am not offering any gratuitous criticism of any specific equipment or method of procedure. I know that everyone that produces in the nontheatrical field sincerely wishes a wider use of this medium and I believe that this can be brought about by constructive thinking along the lines I have suggested.

Silver Soundtracks on a Reversal Color Print Film

By ROBERT C. LOVICK
and RICHARD L. WHITE

This paper discusses methods of obtaining positive silver soundtracks on reversal color films. Data are given concerning the requirements of negatives and copy negatives for soundtrack printing, exposure balance recommendations, and densitometry on Eastman Reversal Color Print Film, Type 5269.

Origin of Sensitometric Requirements

Sound records on black-and-white films have generally been processed in the same solutions and for the same lengths of time required for the preparation of pictures. The general sensitometric relationships of negatives and prints were established before the advent of photographic sound and have been continued with little change for a number of years.

The spectral density of a photographic silver deposit is such that a receptor with almost any response characteristic might have been chosen for use in sound reproducers. A spectral density curve is shown in Fig. 1. The desirability of high sensitivity led to the choice of receptors having maximum response in the near-infrared region. This was a suitable choice because high-sensitivity receptors with this spectral response were available, and also because a tungsten source radiates maximum energy in the near-infrared region.

The introduction of color films complicated the processing problem because it was found difficult to retain silver in the soundtrack area while removing it from the picture area. Dyes used for color photography have relatively little absorption in the infrared. Phototubes having sensitivity in the visible region did not become generally available until after photoreceptors having a response in the near-infrared had come into widespread use. This response is known as S-1. Recently many projectors have been manufactured with lead sulfide phototubes having maximum response in the region 1.2 to 1.5 microns.

Desirability of Silver

Kodachrome Duplicating Film (Type 5265) and other 16mm reversal color duplicating films have generally employed a soundtrack deposit of silver sulfide. The spectral density characteristic of silver sulfide is also shown in Fig. 1. Silver sulfide records with sensitometric characteristics that are optimum for S-1 receptors are grossly in error for any other class of photoreceptor. Indeed, even within the S-1 limits, the variation of the sensitometric characteristic may be quite large. Since both distortion and signal-to-noise ratio of silver sound records are somewhat less dependent on the receptor response, it follows that the reproduction of color films on many projectors could be improved without impairing the result that would be obtained on any other projector if the deposit were silver rather than silver sulfide.

It has been generally supposed that the materials used in filter layers provided the greatest obstacle to the development of a process for silver soundtracks on reversal color films. It is now known that fog and physical development in the negative-silver development step of the color process are far more important.

A process applicable to many integral-tripack color films requires the following steps:

1. Treatment with antifoggant and/or antiphysical developing agent
2. Negative development
3. Fix
4. Color development
5. Bleach
6. Redevelopment
7. Fix

The silver image developed in the negative developer is retained for use as the soundtrack image. The soundtrack is printed from a negative while the pictures are printed from a color positive. It will be apparent that although the color pictures are obtained by reversal processing, the soundtrack is the equivalent of a positive image of the original negative soundtrack. In addition to the uniform spectral density characteristic of the silver deposit, two important advantages are obtained. First, the image contains no dye, as there are no silver halides present in the soundtrack area when the film reaches the color developing solutions. Second, the sensitometric characteristic of the silver soundtrack image is not affected by any of the color processing steps. Control of soundtrack characteristics is substantially better than has been possible in reversal soundtrack processing.

After bleaching, the soundtrack is reexposed and then redeveloped with an alkaline hydroquinone developer containing a suitable quantity of antifoggant to prevent redevelopment of unwanted silver while securing the necessary sensitometric characteristic from the wanted silver.

Processing steps 1, 3 and 6 are treatments to the soundtrack area only. Generally, the film is surface-dried, an appropriate solution is applied to the soundtrack area, a reaction time is allowed, and then that solution is removed by directional washing. A nearly universal process requires three such separate applications. Practical considerations indicate the advisability of eliminating as many as possible of the special treatments that must be applied to the sound area only. The first step of the nearly universal process is the only step that may be eliminated. Successful utilization of the resulting minimum process requires that additions be made to the film emulsions and/or that the negative developer be modified in a manner that reduces fog and physical development to very low levels.

Conflict of Sound and Picture Requirements

The use of negative-positive sound records on reversal color films results in a conflict of desirable negative-silver development characteristics. Fog and

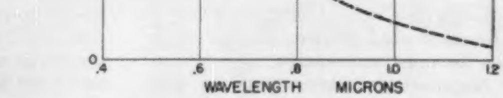

Fig. 1. Spectral densities of silver and silver sulfide.

Presented on April 30, 1956, at the Society's Convention at New York by Robert C. Lovick (who read the paper) and Richard L. White, Color Technology Div., Kodak Park Works, Eastman Kodak Co., Rochester 4, N.Y.
(This paper was received on August 15, 1956.)

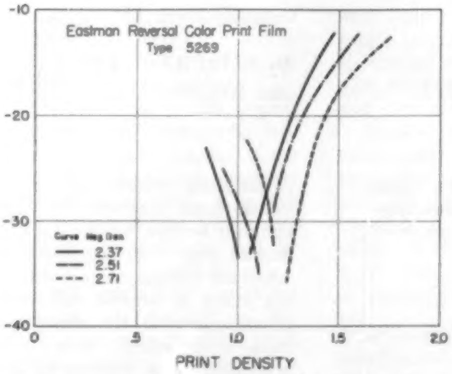

Fig. 2. Typical cross-modulation curves of Eastman Reversal Color Print Film, Type 5269.

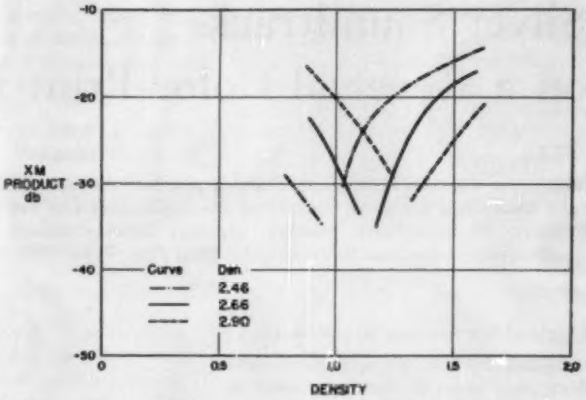

Fig. 3. Cross-modulation curves as a function of negative density

Negative Density	*Print density* 7302	5269	*4000-cycle loss, db* 7302	5269	*S/N ratio, db* 7302	5269
2.37	1.30	1.04	0	−0.8	50.5	45
2.51	1.52	1.15	−0.8	−1.0	52.5	48
2.71	1.80	1.22	−1.3	−1.3	51.5	47
Positive Density	5265		5265		5265	
1.85 (Print)	0.2		−6.5		47	
2.00 (Dir. Pos.)	0.2		−3.5		48	

physical development must be restrained oi low levels in order that satisfactory tmnimum density can be obtained for a satisfactory soundtrack. However, antifoggants generally make complete silver development difficult in the highly exposed areas. Clear highlights in the picture require that the silver halides in these areas be developed to silver, be removed, or in some other manner become unavailable for all subsequent color developers.

Conventional soundtrack negatives are prepared for print processes having contrasts of the order of 2.5. Desirable reversal color pictures require a somewhat lower negative development gamma. The sound process developed for Eastman Reversal Color Print Film, Type 5269 is a two-application process resulting in a positive silver soundtrack. The gamma of the redeveloped silver image is, for the present, somewhat lower than would be chosen on the basis of sound reproduction qualities alone.

Negatives for Variable-Area Records

Normal sound negatives may be employed. The signal-to-noise ratio of optimum density prints from normal negatives is comparable to that obtained with present reversal silver sulfide records on Kodachrome Duplicating Film, Type 5265. Improved signal-to-noise ratio may be obtained at the expense of slightly lower frequency response by increasing the negative density. In order to obtain this improvement it is recommended that negatives be made to a density approximately 0.3 density units higher than would be considered proper for black-and-white films such as Eastman Fine Grain Release Positive, Type 7302. The following data compare various films and show the effect of increasing negative density. The exact specification of sensitometric relationships would, of course, depend upon individual equipment and processing techniques. Contact printing data were obtained on a Bell & Howell Model J printer with internal air jets for improved contact.

Negatives and direct positives were recorded on Eastman Fine Grain Sound Recording Film, Type 7372 and processed to a gamma of approximately 3.5. Signal-to-noise ratio was measured as the ratio of the output obtained from a 400-cycle signal, 80% modulated, to the noise level obtained with an unbiased, unmodulated track. Figure 2 shows typical cross-modulation curves obtained by contact printing 7372 negatives onto Eastman Reversal Color Print Film, Type 5269.

Copy Negatives

Direct positive recordings prepared for release on Kodachrome Duplicating Film, Type 5265 are not satisfactory for direct printing onto Type 5269. The density of an average direct positive is about 1.9. This density is too low to provide adequate signal-to-noise ratio if used as a negative. Moreover, if used as a negative, the noise reduction acts to *increase* the noise at low modulation levels. The density of 1.9 appears to be too high for re-recording; distortion may be unsatisfactory. Whenever the magnetic original is available, re-recording from it is greatly preferred. However, copy negatives may be prepared by printing the 7372 direct positive onto 7372. Using the normal gamma of 3.3 to 3.8, satisfactory copy negatives will have a density of about 2.7 to 2.9. These data were obtained when using a developer of the Kodak D16 type. Figure 3 shows the cross-modulation curves obtained as a function of copy-negative density.

Care should be exercised to insure that emulsion position is proper for the intended purpose. Optical rather than contact printing may be required unless recordings had originally been prepared for both first- and second-generation color prints. Figure 4 shows cross-modulation data obtained by contact-printing the direct positive onto the copy negative base to emulsion. The additional loss of high frequency response is approximately 3 db at 4,000 cycles.

Negatives for Variable-Density Records

Negatives for variable density may be prepared in the same manner as those used for release on 7302. Generally, this means a gamma of 0.5 to 0.6 and density of 0.5 to 0.6. Figure 5 compares the result of contact printing Type 7373 intermodulation negatives onto 7302 and 5269. Lower optimal print densities may be obtained by increasing the gamma of the negative.

Exposure

Both variable-area and variable-density records may be exposed at the same color balance. When the light source is tungsten at 2900 K and the heat absorber is 4.0 mm Pittsburgh 2043, the optimum balance will be obtained by exposing through a Kodak Wratten 2B Filter and Kodak Color Compensating Filters CC-90 cyan plus CC-40 magenta. When the color temperature is unknown, the optimum balance may be determined sensitometrically by a color-balance series using maximum redeveloped gamma as an accurate criterion.

Densitometry

The utilization of silver without dyes makes possible densitometry in either the visible or infrared region. Visual and infrared measurements at 800 mμ differ by about four percent and for this reason should not be used interchangeably.

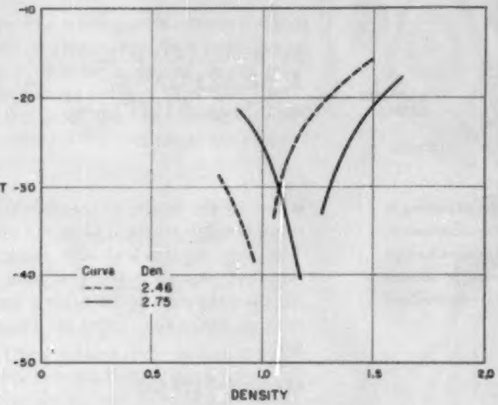

Fig. 4. Typical cross-modulation curves obtained from copy negatives.

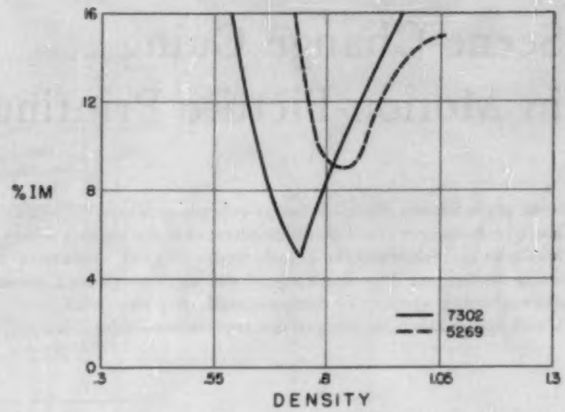

Fig. 5. Typical inter-modulation curves of Type 7302 and Type 5269 films.

However, either type of reading used consistently is satisfactory.

Summary

The preference for a positive silver image rather than a reversal silver sulfide image on reversal color duplicating films has been based on three factors. First, the variation of density as a function of wavelength is greatly reduced. This substantially improves the uniformity of the reproduction of sound from photoreceptors having different spectral sensitivity characteristics. Densitometry is also greatly simplified. Second, the influence of the color processing steps on the soundtrack deposit is considerably reduced. Third, the possibility exists of preparing a single negative suitable for release printing onto Fine Grain Release Positive, Type 7302, Eastman Reversal Color Print Film, Type 5269, or Eastman Color Print Film, Type 7382.

Methods were outlined for the preparation of positive silver soundtracks on reversal color films. A nearly universal process requires three separate operations to the soundtrack area. The minimum process requires two such special operations.

The characteristics of Eastman Reversal Color Print Film, Type 5269, suggest the use of variable-area negatives approximately 0.3 density units higher than normally prepared for release printing on 7302. Copy negatives may be printed from direct positives onto 7372 in order to secure the benefits of noise reduction. Variable-density negatives may be the same as used for 7302. Lower optimal densities may be obtained by increasing the negative gamma. Exposure balance may be determined by conventional distortion tests or closely approximated by printing to obtain maximum redeveloped sound-track gamma.

Discussion

John Maurer (*JM Developments, Inc.*): I don't remember that you showed a sensitometric curve of the effect of this type of processing. Am I right in inferring that if you did have one, it would show a gamma in the neighborhood of 1.2?

Mr. Lovick: The gamma is about 1.2, which is considerably lower than we'd like to have. We know the means at the present time of increasing it as far as the soundtrack is concerned; our major concern is to get the gamma closer to about 2.5 where we would like to see it. We have a minimum density of about 0.11 and we would like to get this down to about 0.04 or 0.05. This higher minimum density and lower gamma are two of the reasons that we are unable to reach the signal-to-noise ratios that you get from a black-and-white film, such as Type 7302. We think that there will always be something of the order of 2.5 to 3 db lower signal-to-noise ratio for 5269 as compared with 7302 for any given print density.

Mr. Maurer: The reason I asked about the gamma of the process is that you mentioned several times that you would like to get higher contrast, and it struck me that you may be overlooking a good bet in relation to variable-density prints on this type of film. Your recommendation for the preparation of a variable-density negative is not very far from the usual practice in variable-density recording. Some work that I have done which, unfortunately, is not by any means ready for publication, indicates that a good deal can be accomplished by a variable-density procedure in which a comparatively high-gamma negative is used; perhaps a gamma of 1 or even 1.2, if the print is made on a rather low-gamma positive stock. By this procedure it becomes possible to balance the nonlinearities of the negative and positive against each other better than usual. It is probable that a comprehensive study of how to prepare optimum variable-density negatives for printing on the new color stock would result in variable-density prints with unusually high level in reproduction, and, in general, quite good quality.

Mr. Lovick: There's also the possibility that some of the people who are interested in electrical recording directly onto the 5269 may much prefer that we don't go up in gamma.

Mr. Maurer: That is definitely right.

[*Authors' Note:* It is always possible to advantageously lower the soundtrack gamma of this type record by selective exposure.

[*J. A. Maurer:* Would the maximum density obtainable in the track area be affected by this method of controlling contrast?

[*Authors:* Reduction of the passband of the exposing filter will reduce the maximum density provided that the filter has good rejection outside the passband. Exposure by means of a Wratten 61 filter will result in a gamma of about 0.8. Such exposure will confine the image to the middle layer with some improvement of resolution. The maximum density is still well over 2.0. Exposure by means of Kodak Wratten Color Compensating Filters will also permit adjustment of gamma. There are two widely separated balances producing maximum gamma, one near the balance 2B + 90 cyan + 40 magenta and the other near the gray-scale balance 2B + 10Y + 20C.]

George Lewin (*Army Pictorial Center*): I'm afraid I missed a point when you spoke about printing base to emulsion — was that just an expedient to avoid making an optical print?

Mr. Lovick: That's right. We had to do something to get from the direct positive to the copy negative. You cannot contact-print a copy negative by printing emulsion to emulsion because the emulsion position of the negative would be reversed for release printing. To restore the relative emulsion position, you must either print optically or contact-print base to emulsion.

Gordon Chambers (*Eastman Kodak Co.*): What about those who can't get optical printing; how bad would it be if they print through the base?

Mr. Lovick: We were quite surprised to find that if you increase the specularity by simply taking out the ground glass, the only significant change is small loss of frequency response.

John P. Byrne (*Army Pictorial Center*): First of all, I would like to get this material straightened out. You're printing on 5269 material reversal color print film and your objection in the first case was the fact that you were using a direct *positive track* (I imagine that's E.K. type 7372 film). What was the objection?

Mr. Lovick: The principal objection to the use of a direct positive is that the noise reduction is reversed, so that instead of getting the benefits of noise reduction, you are accentuating the noise every time a low-modulation passage arrives.

Mr. Byrne: Thank you. Can we go a step further? Suppose we're using a Type 7372 track negative at approximately a 2.50 density, and we have *two* separate films; we have the picture film, which is possibly a Kodachrome; and we've an E.K. 7372 negative track. Now, we make a composite on the printer and we have *one* strand of film, the picture *and* the soundtrack. Not being familiar with the processing of a composite color print, what is the procedure when processing the picture and the track, which are on the same strand of film? I imagine that somehow the soundtrack must be masked in the processing operation so that the picture gets the dye and the soundtrack gets the proper processing. Can you tell me how that's accomplished?

Mr. Lovick: The process for Type 5269 is as follows. We go directly into the negative silver developer. The steps underlined in red on this slide are treatments to the soundtrack only. If the sound track is printed from a negative, then in the negative silver-developer of the color process, a positive image of the soundtrack is formed. If the soundtrack area only is then fixed, you'll have essentially the silver soundtrack deposit required, and anything that takes place in the color development will not affect the soundtrack appreciably. You can then go ahead and do any color processing operations independent of the soundtrack. After the bleach, you must redevelop the silver in the soundtrack area only.

Scene-Change Cuing in Motion-Picture Printing

By R. C. LOVICK
J. M. SEEMANN,
and J. G. STOTT

Some of the history of scene-change cuing in professional motion-picture printing is given. Advantages and difficulties inherent in the various techniques are discussed. Methods are described for greatly improving the conductive-patch scene-change cuing technique. The accuracy of the edge-notch and conductive-path scene-change cuing systems is demonstrated. A pulse-delay mechanism is described which makes notch covering or cue replacement unnecessary.

A motion picture is made of many scenes photographed and processed at different times and under different conditions. During the final release printing of the motion picture, scene-to-scene changes in printing exposure must be made to compensate for differences between scenes resulting from variations in exposure and processing. It has been the general practice for many years to punch a notch in the edge of the printing original near the scene change so that a sensing device on the printer can respond to the notch, change the printer light by one means or another, and cause the new scene to enter the printer aperture at the instant the change is made.

Because of the large variety of printers in motion-picture laboratories, it has not been possible to standardize the position of the notch in relationship to the scene change. Some printers sense a notch placed ahead of the scene change and some at the scene change; for others, the notch must be behind the scene change. These and other differences have resulted in considerable confusion and much difficulty in printing an original film in one laboratory after it has been notched in another.

Because of the permanent characteristics of the edge-notch cue, a great deal of work has been done by many people during the last six years to develop a different, equally effective, yet non-permanent scene-change cuing technique to be used as a trade standard. The result of their work is a completely different and much more flexible cuing system. This paper concerns studies carried on in the Color Technology Division of the Eastman Kodak Co. to evaluate much of the work that has been done and arrive at some specific conclusions and recommendations.

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Presented on April 30, 1956, at the Society's Convention at New York by R. C. Lovick, J. M. Seemann (who read the paper) and J. G. Stott, Color Technology Div., Eastman Kodak Co., Kodak Park Works, Rochester 4, N. Y.
(This paper was received on August 30, 1956.)

The requirements imposed on a cuing system are many:

(1) The cuing system must be reliable. Every cue must be sensed without a miss until a large number of prints has been made.

(2) The system must be accurate. A given cue must make the printer solenoids change the light at the instant the scene change is in the gate. Variability here will result in mislighted frames at the scene change.

(3) The equipment must be inexpensive.

(4) The cues and sensing system must not damage the film.

(5) The cues must not change with storage.

(6) The system must be compatible with the printer mechanism. It must not interfere with emulsion contact or printer operation.

(7) The cues must be easily applied and removed.

(8) The cues must be able to withstand repeated film cleanings without being harmed.

(9) The system must allow visual inspection for defective cues.

Up to the present time many different cuing and sensing methods have been tried. All have had serious drawbacks.

Edge-Notch Cuing

The edge-notch cuing system is the most widely used of all the systems known. It is very reliable and accurate when used correctly. However, the permanent characteristics of the edge notch make it very difficult to change the notch position once the film has been cued. This inflexibility means extra expense and difficulty if it ever becomes necessary to print the film in a laboratory employing a different notch position from the laboratory which originally notched the film. When a film is renotched, the old notches must be covered by a piece of film base cemented to the original. The film base is cut to the shape of the notch plus a small overlap where it joins the original. The joint creates a double thickness of film that causes loss of contact and an objectionable jump in the printer that may have a noticeable effect on the release print.

Conductive-Patch Cuing

In this method an electrically conducting spot is applied to the edge of the film. When the spot passes over an insulated split roller on the printer, it shorts the roller and causes a current to flow which can be amplified to activate the light-change devices. A complete discussion of this method appears later.

Magnetic Cuing

In the magnetic-stripe cuing system the original film must be striped along both edges with a magnetic material. A very short 400- or 4000-cycle signal is recorded on the stripe for each cue. A given cue may have a 400-cycle signal, the next one a 4000-cycle signal, and so on, with the signal frequency alternating from scene to scene. During printing, a magnetic sensing head touches the stripe and picks up the very brief cues. A discriminator circuit that will not pass two successive pulses of the same frequency makes sure that a pulse missed for any reason will cause mislighting of only one scene instead of the whole reel.

Serious difficulties have been found with magnetic systems. During the coating of the magnetic stripe the film can be damaged. Because the magnetic sensor must touch the stripe, a little of the material is constantly being rubbed off, causing dirt problems. When the stripe is coated on the emulsion side of an original being printed by contact methods, the definition of the release print suffers because the thickness of the stripe does not allow perfect contact between the printing master and the raw stock. The stripe will sometimes transfer to the film base during storage. Stripes applied to the base side of the film may cause damage to printer elements. No visual check of the cue condition can be made. The striping of the original film is expensive, as are the cue-making, checking and sensing systems.

Magnetic adhesive-tape patches have many of the drawbacks of the magnetic-stripe cuing system.

Optical Cuing

If an optical cuing system is used, a white tape or lacquer patch is applied to

the film. The white patch reflects a light beam into a phototube which produces a pulse that can be amplified to operate the light change devices. Dirt and abrasion of the patch may change its reflectance characteristics and cause the cue to be missed.

Capacitive Cuing

In the capacitive cuing system an adhesive-tape patch of "Mylar" polyester sheeting with an aluminum layer between the adhesive and the Mylar sheeting is used to change the capacitance of a probe. The resulting pulse is then amplified to operate the light-change mechanism. In order to obtain sufficient sensitivity, the probe voltage must be high, or rather expensive resonant amplifiers are required. Drawbacks to this system are the high cost of the electronics or the shock hazard present in the high probe voltage.

Synchronized Punched-Tape Cuing

In another cuing method a film, paper strip, or card is punched with the light-change data. During printing, the strip is synchronized with the film and the data picked up by a reader. This leaves the original film free of any cue marks whatsoever. However, the equipment is somewhat costly, and another possible source of error is introduced in punching and synchronizing the cued film, paper strips, or card.

Of all the cuing systems described, the conductive-patch cuing technique meets more of the necessary requirements than any other. When this was realized, a thorough investigation of the technique was undertaken.

Method of Conductive-Patch Cuing

In the simplest type of system, a small patch of adhesive-coated metal foil is placed on the edge of the film. The instant the leading edge of the foil patch touches the split roller, it bridges the gap between the roller halves, causing a voltage drop on the grid of an amplifier. The amplified signal closes a relay switch in the printer solenoid circuit.

A conductive-patch material has been found that is easily applied and removed, yet will not come off accidentally during printing or film cleaning. A split roller has been used with a new electronic relay. A new cue-pulse delay circuit has been devised which accommodates many different cue-to-scene-change distances.

The Sensing Roller

The pickup roller used in these tests is illustrated in Fig. 1. A Hysol plastic core insulates two narrow lands from each other. When the conducting spot on the film bridges this gap, it activates a relay which sends a pulse to a light-change solenoid or time-delay mechanism. The conic bronze axle bearings have binding posts at their ends to which the input wires are connected. If the need arises, the roller can be remounted with its axis rotated 180°. The bearings are very sparingly lubricated with a high-grade machine oil. The yoke supporting the roller must be made of Synthane or other insulating material.

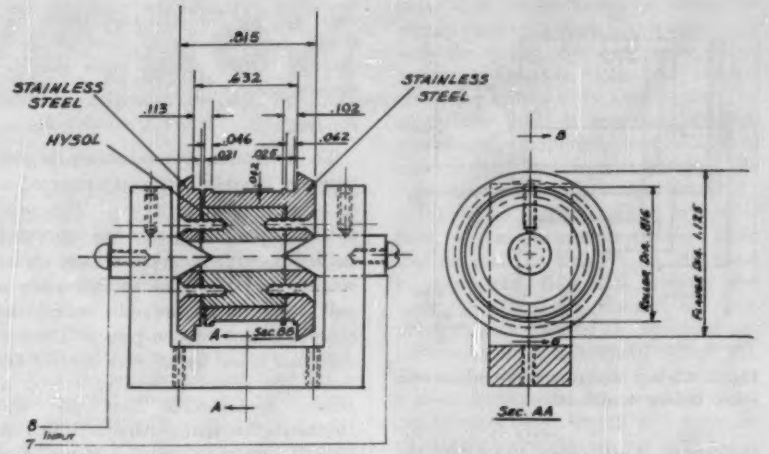

Fig. 1. Engineering drawing of split roller for conductive-patch cuing of 16mm film.

Characteristics of Electrically Conducting Materials

Many tests of various conductive-patch materials have resulted in rejection of all liquids and pastes directly applied to the film. "Aqua-Dag," for example, is a colloidal graphite suspension containing water which swells the gelatin emulsion. When the spot is removed, a raised line remains around the area where the spot was applied. With all liquids and pastes there is a danger of spillage during application and removal, or flaking during printing. Any material or system that might in any way harm the film being cued has been discarded. An adhesive-tape patch gives little chance of film damage or operating difficulty. The size and location of the patch are the subject of a proposed American Standard* and will not be discussed here.

A number of tapes were tested, and some factors were found that determine how successfully a tape will make conductive cues.

The tape must be very thinly coated with an effective adhesive. A thick coating gives a soft, "mushy" foundation for the conducting surface, allowing it to be slid out of position as it goes over the printer rollers. If the coating is too thick or the tape too flexible, a large area of soluble adhesive may be exposed to the film cleaning solutions so that the conducting surface is easily contaminated with nonconducting adhesive. If the adhesive coating is slightly soluble in film cleaner, the pressure of the printer rollers will tend to rebond the patch to the film wherever an edge has been raised. Where film cleaner has slightly wetted the under surface of the patch, the adhesive characteristics are improved and, when pressed by the printer rollers, the patch adheres more closely. Some adhesive coatings that are not soluble in the film cleaner will not rebond to the film surface once they have been wet. When this happens, the area of adhesion is progressively reduced as the film cleaner penetrates between the patch and the film, and the patches are accidentally removed during printing or cleaning.

The patch must maintain its conductivity after it has become somewhat worn from passing through the printer. It was found that a number of conductive paints applied to tapes and used as patches did not work well because the paints had a tendency to chip or flake under severe conditions. A somewhat stiff aluminum foil made an excellent conductive material.

The stiffness of the tape is important because the edges and corners of the patch must resist being raised. If the cue patch is applied manually, the edges should be lightly embossed to minimize the adhesive area that can be attacked by the film cleaner. The patch must be stiff enough to maintain its turned-down edge and smooth surface, yet flexible enough to bend as it travels over the printer rollers.

The tape should be as thin as possible because the clearance between the printer sprockets and their idler rollers is usually set for the thickness of only two films. When an aluminum patch goes through a printer that has not been adjusted for the extra thickness, the edges of the printer sprocket idler rollers emboss the aluminum until the metal fatigues, crystallizes and crumbles. This difficulty can be corrected completely by proper adjustment of the idler roller

* Proposed American Standard PH22.89, Printer Light Change Cuing of 16mm Negatives.

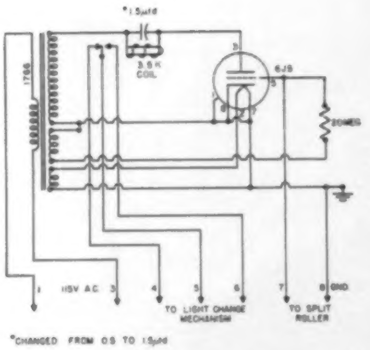

Fig. 2. Circuit diagram of a-c electronic relay before modification.

clearances. With proper spacing of the rollers, a cue patch can go through the printer more than 2,000 times without undue wear.

The tape patch must be applied easily to the correct spot on the film. This can be accomplished by the use of a punch that cuts the tape and applies it in one operation. The tape must also be removed easily without leaving behind bits of adhesive or removing any of the emulsion.

Tape cues should be applied to the surface of the film that comes in contact with the raw stock being printed. This will prevent any patches from being scraped from the film and jammed in the printer gate. The tape, however, should stick to either the emulsion or the base to accommodate unusual situations.

A satisfactory tape is "Scotch" brand Pressure Sensitive Adhesive Tape No. 425 made by the Minnesota Mining and Manufacturing Co. Five patches of this tape were used on a loop that was run through the printer 600 times. The loop was cleaned with Kodak Film Cleaner after every five cycles through the printer. The loop was run an additional 600 times with cleaning every 50 cycles. In all the 6,000 patches to be counted, not one was missed. No sign of serious wear showed on the patches. In all the tests run, no No. 425 tape patch has shown any tendency to come off accidentally. Other similar tapes may be equally suitable.

Reliability

To determine the reliability of the tape cue, the split roller was connected to an a-c electronic relay (Fig. 2). The open-switch output of the relay was connected in series with a Veeder-Root pulse counter and 110-v a-c so that when a patch went over the split roller, the counter registered one pulse. The cue materials being tested were applied between the sprocket holes of a loop of 16mm Kodachrome film that was threaded through a Model J Bell & Howell Contact Printer. A second loop was used to simulate raw stock. Five patches and one edge notch were put on the original loop. The edge-notch switch was connected in series with a second Veeder-Root pulse counter, which recorded once for each complete cycle of the loop through the printer. Assuming the edge-notch switch to be infallible (it missed only twice in all the thousands of passes made), the edge-notch switch pulse count × 5 equals the number of patches that should have recorded, while the split roller pulse counter gives the actual number of pulses counted.

During the reliability tests, the loop was cleaned with Kodak Film Cleaner after every five passes through the printer.

One of the main factors determining the reliability of the tape-patch sensing system is the degree of contact between the film and the split roller. In the early tests the film contacted the split roller over about 40° of its periphery. It was found that many of the cues were missed completely under this condition. A pressure roller was added and the film contact with the split roller increased to 160°. Since this change no cues have been missed unless the cue was damaged.

While the Veeder-Root pulse-counting system was being used, the output of

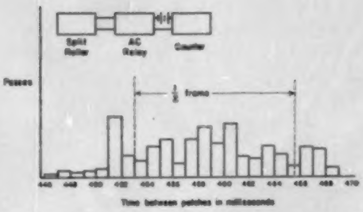

Fig. 3. Variation encountered in measuring the constant interval between two conducting patches with an a-c relay.

the split roller was fed into an electronic relay. It was noticed that quite often the Veeder-Root counter would gain two counts when it should have gained only one. It was determined that sometimes when a patch went over the split roller, the patch "bounced," giving two pulses. The original design of the electronic relay operated so rapidly that it was able to count these double pulses if they occurred more than a few tenths of a second apart. By increasing the size of the relay-holding capacitor in Fig. 2, the relay was held down by the first pulse until the patch cleared the roller. This change completely corrected the double pulse-counting difficulty.

Accuracy

In any cuing system, the cue-to-scene-change distance is very carefully maintained in order to prevent the light change from occurring anywhere but at the scene change. In order to obtain accurate positioning of the light change, the sensor must be activated identically by every cue that passes. In every cuing system the sensing accuracy must be determined. When no test equipment is available, cuing accuracy can be checked by making a number of prints of a short loop bearing two light-change cues.

A visual check of the cuing accuracy may be made by carefully placing a cue every five frames on the emulsion side of a film loop and then marking a thin white ink line across the base side of the film at the beginning of each cue. A stroboscope or other repeatably-keyed, fast-peak light source is then connected with the cue-sensing switch and aimed to illuminate the white line corresponding to the cue being sensed. If the light

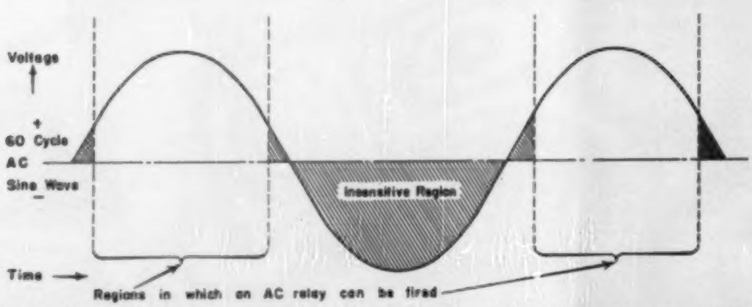

Fig. 4. Sensitivity periods of the a-c electronic relay. A certain positive potential is needed on the plate of the relay trigger tube for that tube to conduct when the grid is grounded. Fifty per cent of the time the plate is negative; and for part of the remaining time, the potential across the tube is too low to pass enough current to activate the relay switch. The system is sensitive only to events occurring during the period in which the relay can be fired.

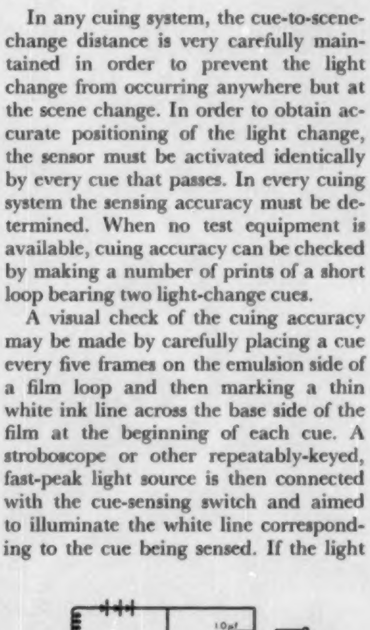

Fig. 5. Circuit diagram of electronic relay after conversion to a d-c circuit.

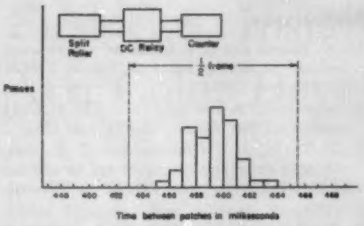

Fig. 6. Variation encountered in measuring the constant interval between two conductive patches with a d-c relay.

source gives a very short flash every time a cue is sensed, the white line for each cue will appear to stand still, even though the film is moving rapidly past the sensor. If the light flash always makes the white lines appear in exactly the same spot, the cue-sensing accuracy is probably good. The variation in position of the white line revealed by the flashing light is similar to the variability of the light-change position that will appear on a release print. Such a test method was used with the stroboscope attached to the open switch of an electronic relay. A large degree of variability appeared that was not present when the stroboscope was attached directly to the split roller.

A more accurate variability measurement was made by running a loop with only two cues through the printer. The open switch of the a-c electronic relay was connected in series with a 22½-v battery and the input of a Berkeley Model 5500 Interval Timer and Decimal Counting Unit. This counter was used to measure repeatedly and accurately the time between two cue pulses on a loop as it passes through the printer.

Figure 3 is a plot of 219 measurements of the same interval by the Berkeley counter connected to the a-c electronic relay. The large variation indicates that the system is not as accurate as it should be. Figure 4 is a diagram of the alternating-current sine wave on the plate of the 6J5 tube in Fig. 2. When the plate is negative in charge, the tube cannot conduct, even if the grid is at ground potential. Only when the plate is positively charged and attracting electrons can the tube conduct if the grid is grounded. When the plate is positive, a minimum cathode-to-plate potential must be exceeded to overcome the internal resistance of the tube. Because of these a-c characteristics of the circuit, a cue pulse can be accepted only for a brief period when the plate potential is above a certain positive level. At 60 cycles/sec, this condition of acceptance may exist for less than 8 msec out of every 16.6 msec (one a-c cycle). Doubling this variability (because two patches were used) makes possible the assumption that 16 msec of the variation in Fig. 3 is due to the use of an a-c relay circuit. When it was realized that this electronic relay was unusable, improvements were made in its circuit (Fig. 5). By converting the relay from an a-c to a d-c circuit, the response of the relay is markedly improved to give the small variation shown in Fig. 6.

Delay System

A new electronic relay (Fig. 7) has been designed incorporating a magnetic time-delay mechanism to hold cue pulses for a specified time so that originals can be printed that had been cued for a different sensor-to-gate distance. In this system (Fig. 8) every time a cue shorts the split roller, a very brief pulse from a 3,000-cycle oscillator is recorded on a magnetic disk rotating at 33⅓ rpm. The disk is made by spray-painting a recording blank with magnetic iron-oxide paint. The cue-delay time is the time required for the pulse to be moved by the turntable from the magnetic recording head to the magnetic pickup head. As the pulse is moved under the pickup head, the current it induces is amplified enough to operate a relay switch in the light-change solenoid circuit. The cue-delay time can be varied by sliding the pickup head on a track that is concentric with the record. After the pulse passes the pickup head, an Alnico erase magnet clears the record to be used again. The split roller pulse is recorded, delayed, reproduced, amplified, and made to close a relay switch that operates the light-change solenoids on the printer.

When the magnetic delay system is used, several pulses that are very close together can be delayed on the same magnetic recording disk without the need for a separate channel for each pulse, characteristic of an electronic delay system. In the magnetic system the delay time for every pulse is the same at a given setting, and the turntable speed can be accurately checked with a simple phonograph stroboscopic test card and a neon lamp. The delay time of the magnetic system can be set and reset quite accurately if the concentric track is marked off in half-degree units. The variation inherent in the magnetic-delay system is shown in Fig. 9.

When masters are printed that have been cued for the specific printer, the

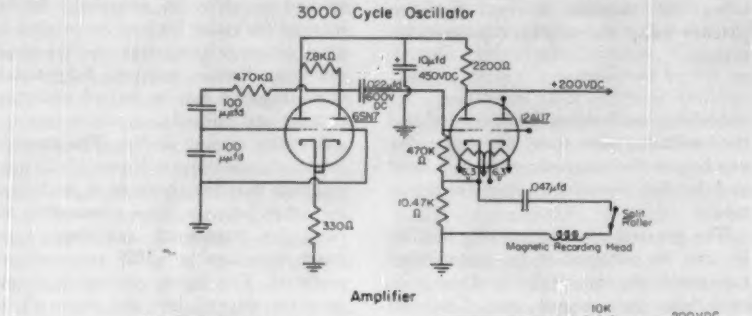

Fig. 7. Circuitry used in magnetic pulse-delay system and light-change system of the printer.

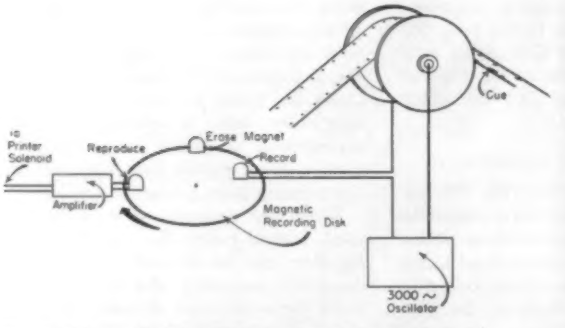

Fig. 8. Schematic diagram of scene-change cuing using conducting patches and magnetic pulse-delay system.

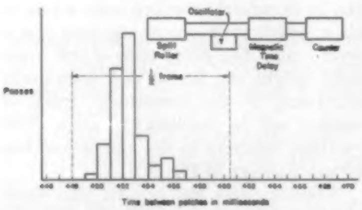

Fig. 9. Variation encountered in measuring the constant interval between patches using the magnetic pulse-delay system.

time-delay mechanism is not needed and the oscillator pulse from the split roller can bypass the magnetic recording head and be fed directly to the Thyratron tube.

The greatest possible printing flexibility can be obtained if the conductive-tape patch, electronic relay, and magnetic time-delay systems are used. Originals that have already been notched with a nonstandard cue-to-scene-change interval can be printed easily by either recuing with conductive patches or by connecting the time-delay mechanism to the edge-notch roller instead of the split roller. Correct adjustment of the time-delay mechanism then allows normal printing operations to be carried out.

Conclusion

The scene-change-cuing system described provides an extremely flexible method for cuing films to be printed by using either existing edge notches or applied conductive patches. Edge-notch-cued originals can be recued with tape patches and printed on a printer having a split-roller sensing device. The time-delay mechanism makes it possible to print originals that have been edge-notch cued for other printers, thus eliminating the need for edge-notch covering. Tape-patch cues can be easily removed and replaced. The cuing method is simple, accurate, dependable, and above all, inexpensive and safe.

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Discussion

Emmett Salzberg (Circle Film Laboratories): Have you made any studies concerning the maximum film speed at which this system is operable?

Mr. Seemann: No, we haven't. We have been using a printer that operates at 60 feet a minute; we would have to retest any new type of printer that operated more rapidly.

James W. Kaylor (Movielab Film Laboratories): What type of film cleaning did you use? I have made several tests and found that when using carbon tetrachloride, there is a residue of adhesive that squeezes out and picks up lint from the velveteen.

Mr. Seemann: We used a nylon velveteen soaked with Eastman Kodak Film Cleaner and held against the film with a light pressure.

Mr. Kaylor: There were no fibers picked up?

Mr. Seemann: As far as I was able to see there were not.

Carl F. Turvey (U. S. Dept. of Agriculture): Is this tape commercially available?

Mr. Seemann: I believe it is.

Mr. Turvey: Is there any arc created when this tape contacts the split roller?

Mr. Seemann: No, there is not.

Errata
(and Belles-Lettres)

R. D. Chipp, "The Du Mont Telecentre," *Jour. SMPTE, 65:* Oct. 1956.

The titles on Figs. 12 (p. 541) and 13 (p. 542) were interchanged. Figure 12 is "Layout of audio console." Figure 13 is "Typical audio block as used in broadcasting."

In the same paper (p. 540) some credit-due wording went askew. We are nicely set aright by:

Dear Editor:

We fear that the Du Mont Telecentre's half dozen Magnetic Tape Reverberation Units are credited to the wrong manufacturer.

These units are manufactured and sold by the Audio Instrument Company, Inc., not by Audio Devices. We regret that so many organizations use the name Audio — particularly those who are over ten years older than we!

Very truly yours,
AUDIO INSTRUMENT COMPANY, INC.
(Signed) *C. J. LeBel*

First U.S. Installation of Arri Color Developing Equipment

By ROBERT E. JOHNSON

A modern postive-negative color developing installation built around the Arri Color Machine has recently been completed by Byron, Inc. This installation makes extensive use of polyvinyl chloride plastics both in machine design and auxiliary equipment. Before the new equipment, including chemical mix, control and developing sections, could be added to the laboratory, extensive alterations were made in an existing building.

Following a decision to add the color negative-positive process to its laboratory, the firm of Byron, Inc., Washington, D.C., made a thorough study of developing machines of American and European manufacture for the purpose of selecting the machine that could best be adapted to the company's production needs. The Arri color machine built by the Arnold & Richter Co., Munich, Germany, was found to be the most suitable. There were, however, certain modifications necessary to meet specifications.

Approximately three years were required to plan and complete the installation, the first of its kind in the United States. Although the use of this machine for positive release prints would be entirely in the 16mm field, it was thought advisable to install both 35mm and 16mm rollers, as there was no 16mm negative available at the time the machine was delivered.

Building Preparation

As a first step toward adapting the machine to its special requirements, Byron, Inc., acquired a building adjoining its plant. Arnold & Richter supplied the blueprints and recommendations for altering the building. A doorway was cut through to allow passage between the two buildings. New sewer lines and water mains were installed. Concrete floors were poured and acid-proof tile (Fig. 1) was laid on the concrete in the pit around the developing machine and in the chemical mixing room, sloping to the various drains. White vinyl tile was installed on the walking surfaces. Catwalks were built in the center portion of the mixing room and around the developing machines. These walks were made of cypress, using only stainless-steel bolts and stainless-steel nails. The walls were painted with a rubber base paint and all metal parts were painted with Neoprene latex paint, which was also used on the wood sectio[illegible]. The walls were painted gray up to the same height as the machine tanks and the top walls and ceilings were painted white.

The machine is 36 ft long and is composed of 22 individual tanks. Three of these are used for positive developing, and three for negative developing. Figure 2 shows the parts of the machine before assembly. Twelve of the tanks are located in the darkroom and the remainder in the light section. The walls separating the light and dark areas have electrically interlocked doors and a light trap for film passage.

The light section of the machine room contains a refrigerator and deep freeze for the storage of film to be processed. Lumiline tungsten filament lamps are used rather than fluorescent lamps in order to minimize annoying stroboscopic effects upon moving film.

A Westinghouse air conditioner is fitted up for both heating and cooling. The furnace is a gas-fired hot-water heater. Motorized valves are used to regulate the amount of filtered fresh air entering the building and separate ventilating fans are used in the chemical mixing section to exhaust harmful dusts and fumes.

New Problem for Arri

Byron's original specifications for the developing equipment required that the film be kept completely submerged while in the developing solutions. This was a new problem for Arri and required certain design modifications. The submerged drive is accomplished by the use of nylon gears in a polished stainless-steel housing (Fig. 3). Nylon bushings are also used below the solution level. The top rollers and entire drive section in the dark end of the machine can be raised approximately 18 in. by the use of an hydraulic lift to facilitate threading of the submerged rollers.

A train of gears drives the stainless-steel shafts which are at the top of the machine and on which the polyvinyl chloride rollers ride. The shafts have no support at the outer end, this making for great ease in threading (Fig. 4). On each driveshaft there are two 16mm and two 35mm sprocket rollers. The 35mm sprockets are adapted to CinemaScope perforations and the remaining rollers on each top shaft are combination 35mm

Presented on April 30, 1956, at the Society's Convention at New York by Robert E. Johnson, Byron, Inc., 1226 Wisconsin Ave., N.W., Washington 7, D.C.
(This paper was received on August 17, 1956.)

Fig. 1. Installing acid-resisting tile floor.

Fig. 2. Parts of machine being identified before assembly.

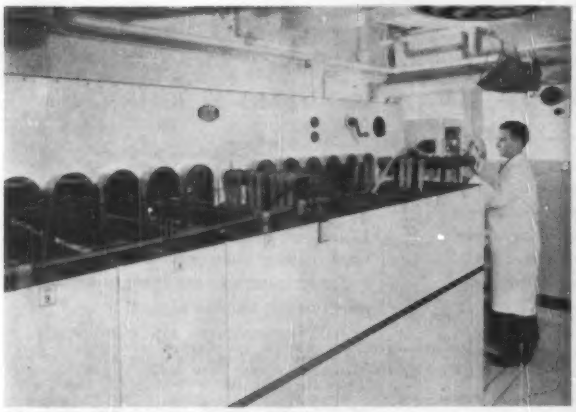


Fig. 3. Darkroom end.

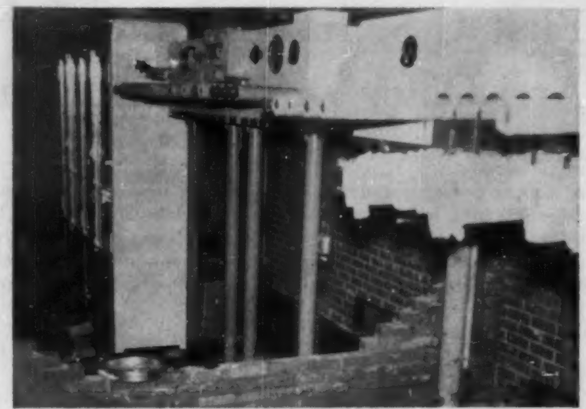


Fig. 4. Basic drive mechanism during installation.

and 16mm. There are two elevators for each driveshaft, riding in tracks made of polyvinyl chloride. These two bottom elevators in each tank are each composed of three combination 16mm and 35mm rollers. The developing tanks themselves are made of half-inch red polyvinyl chloride with a thin white coating of the same material on the outside.

Recirculation System

All the solutions in the machine are recirculated with the exception of the stabilizer and the soundtrack developer. The solutions are fed through manifolds into the machine tank at each side and then through four vertical stainless-steel tubes located on each side of each tank. These tubes extend from the bottom of the tank to within about 6 in. from the top. The tops of the tubes are sealed, and there are 18 holes at various levels from which the solution is forced out under pressure onto the emulsion side of the film. For example, the output of each developer pump is forced through 432 outlets. This gives excellent turbulation throughout the tank.

The supply mechanism and its elevator at the end of the machine are of conventional design, except for the friction drive that is operated only when the solenoid film brake is on (Fig. 5). This aids in feeding the film out of the elevator. Air squeegees are built into the machine before each chemical solution as well as on the output side of the fixing baths. These squeegees minimize dilution of the chemical baths. Carry-over is permitted into the wash water. A Nash Model L-4 compressor provides 280 cu ft/min at approximately 30 lb pressure, providing air for the squeegees as well as other equipment throughout the laboratory.

In addition to the pressure squeegees, the Arri machine is equipped with two vacuum squeegees connected to a vacuum pump in the machine itself and located just before the soundtrack applicator and just before the dry cabinet. These vacuum squeegees are so satisfactory that we have no need for a wetting agent. The soundtrack applicator is of the roller type and is driven by a variable-speed motor. It is adjustable for the positioning of the track on either side of the film, as well as for pressure of the stainless-steel applicating disk. Figure 6 shows the daylight wet section after basic assembly.

At the time of ordering the machine, we asked Arnold & Richter about the advisability of using impingement drying. That was three years ago, and it was their opinion at that time that impingement drying had not yet been proven for negative films.

Our drybox is of rather conventional design (Fig. 7). It is a closed system with rotary-type fan blowing air through a thermostatically controlled heater into the cabinet. Glass partitions direct the flow of air past the banks of film. The air then goes through a dehumidification

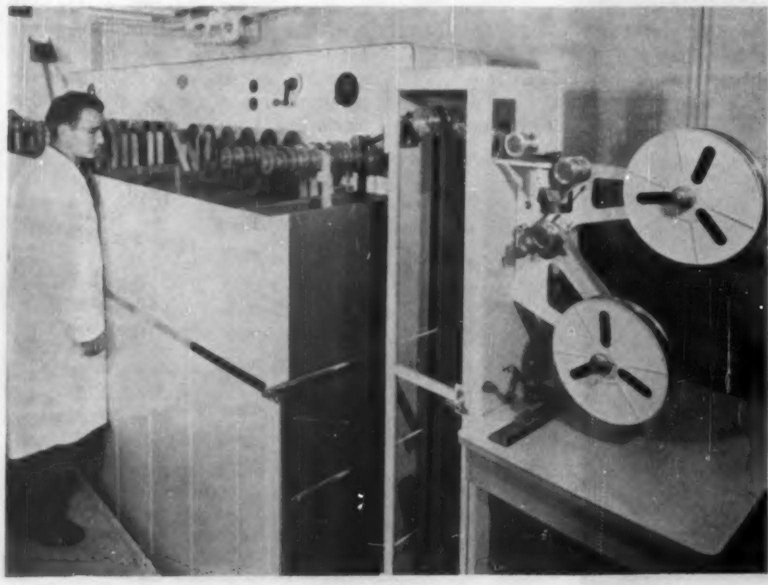


Fig. 5. Supply mechanism, darkroom section.

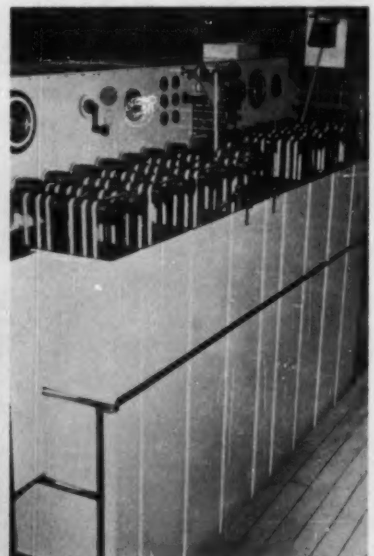


Fig. 6. Daylight wet section after basic assembly.

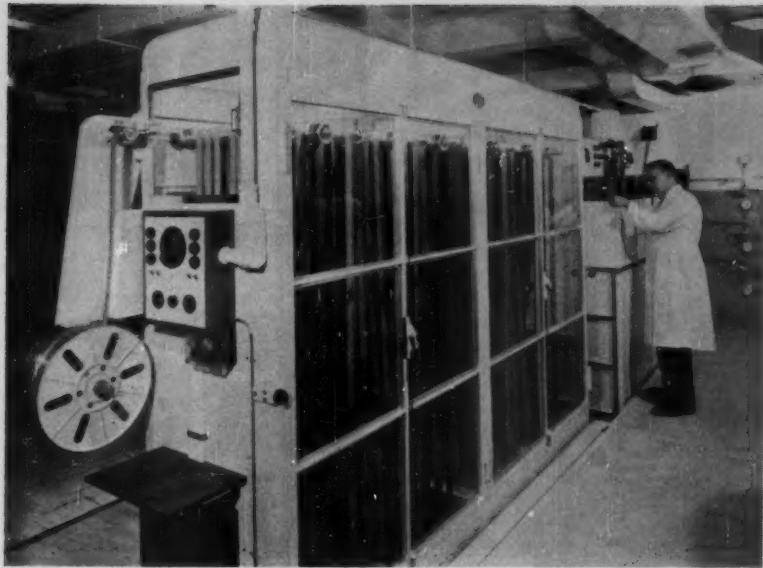


Fig. 7. Closed air system, dry cabinet.

coil and the cycle is repeated. Two static eliminators are located near the take-off end of the dry cabinet. The take-up end of the machine is conventional. The controls for temperature and humidity of the dry cabinet are located at the take-up end.

Solution Temperature Control and Chemical Mixing

The main control panel (Fig. 8) is located in the wall, close to the take-off end of the machine. The temperature indicator and controls for all the solutions with the exception of the developers are located above each bath. These controls are accurate to plus or minus a quarter of a degree. The temperature controls and indicators for the negative and positive developers are located on the main control panel. These are extremely accurate and can control temperatures within plus or minus an eighth of a degree.

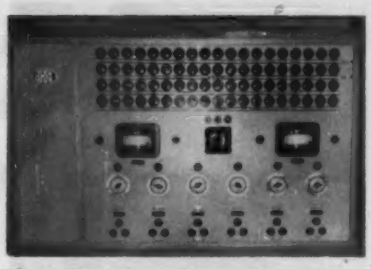


Fig. 8. Control panel.

For our washes we use the Washington, D.C., city water supply because no water is available by drilling. The water is piped from the Potomac, and the water temperature varies from a high of 88 F to a low of 33 F. Thus it was necessary to design a system that could provide a uniform temperature for mixing and washing the films throughout the year. Two instantaneous gas water heaters and a water chilling system using two separate units were installed for control purposes.

Three separate water-mixing valves are mounted on the wall of the light section, adjacent to the machine (Fig. 7). The top mixer regulates the water in the dark-end section; the second mixer regulates the final wash. The bottom indicator shows the temperature of the tap water. All water is filtered through a large Cuno filter. The chemical mixing room is adjacent to the developing-machine room. The space was adapted to include our present black-and-white chemical mixing facilities. Alsop Engineering constructed our mixing and replenishing tanks (Fig. 9). These are made of 16-gauge type 316 stainless steel, with sloping bottoms. Each mixing tank is equipped with a slow-speed mixer using two up-draft propellors off-center. Alsop positioned these mixers so that we would secure maximum turbulation with minimum oxidation. The bottoms of the mixing tanks are valved to the floor for washing, and are also valved to small transfer pumps that move the solutions to the replenishing tanks for storage.

In order to eliminate errors and variations that might occur in the daily weighing of chemicals, it was decided to pre-weigh all chemicals; one man doing the actual weighing and another man overseeing. Several weeks' supply is weighed at one time and placed in plastic bags. These bags are coded by color, letter and number; indicating the bath, the order of the ingredient and the mixing time. This gives a consistency in weighing and mixing that eliminates variations.

Replenishment System

The replenishing tanks are on an elevated platform located on the opposite wall adjacent to the developing-machine room (Fig. 10). This platform is actually a rubber lined trough supported by steel I-beams. The reserve tanks are of the same construction as the mixing

Fig. 9. Chemical mixing.

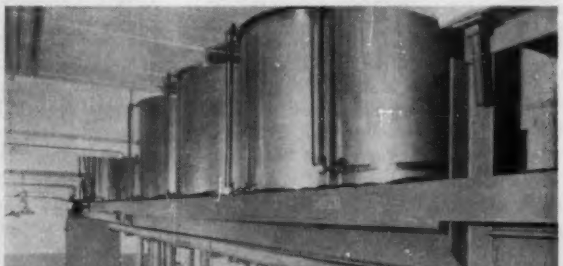


Fig. 10. Replenishing tanks.

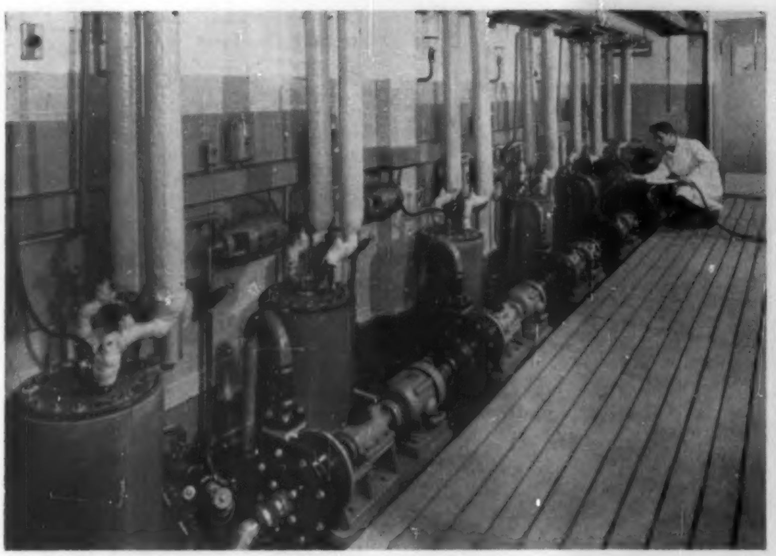


Fig. 11. Recirculation pumps and heat exchange tanks.

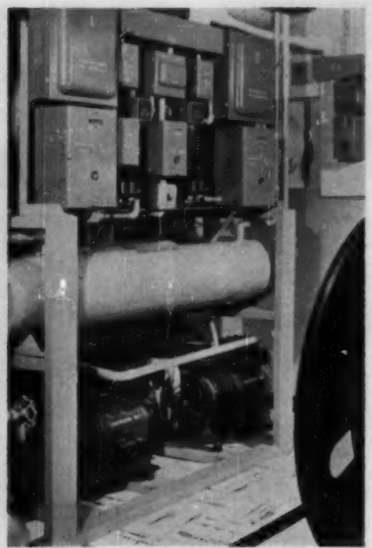


Fig. 12. Water chilling units.

tanks, except for a liquid-level gauge. The negative and positive developer tanks have floating stainless-steel lids to minimize oxidation. Both the bleach mixing and reserve tanks are rubber lined. Stainless-steel, liquid-level control switches were installed on the replenisher tanks to control both the low and high levels of the solutions.

All replenishing tanks can be drained to the floor for cleaning, but are normally valved to a replenisher metering device located just under the elevated platform. This metering device is a closed chamber vented to the top of the room and is equipped with a double-acting solenoid valve, activated by a synchronous clock. The chamber is exactly one liter in size and is made of transparent plastic. The timer on the control panel can be set for any time interval from 1 to 15 min. Replenisher rates, can therefore, be adjusted to anything between 4 and 60 l/hr. These chemical additions are made directly into the bottom of the machine tanks.

Hypo replenishment is made only into the first fix tank of the color machine. The overflow from the first fix is fed into the second fix at a slightly lower level. The overflow from the second fix is fed into the silver recovery unit. The hypo is then pumped over to the black-and-white machines and back again. The silver recovery unit, also made by Arri, employs rotating carbon electrodes for agitation. The tank itself is made of polyvinyl chloride, and the controls are adjacent to the main control panel of the developing machine.

Filtering and Temperature Control

The heat-exchange tanks that were provided with the machine originally were of polyvinyl chloride. The recirculation pumps provided a pressure that

Fig. 13. Chemical control.

was too great for the polyvinyl chloride, and leaks in these chambers occurred. This problem was solved by Arri, when they replaced these tanks with stainless-steel tanks. Arri incorporated a little venting arrangement with a rubber hose and a valve so that samples for chemical analysis can be easily obtained (Fig. 11).

Forty-five degree water from the water chiller flows through the stainless-steel coils in the heat-exchange tanks (Fig. 12). The flow of chilled water is controlled by a solenoid valve. A stainless steel electric heater is located in the center of the tank. Thermostats are placed in the recirculation system in the supply side of the line at the bottom of the machine tank. The recirculation pumps, themselves, are of plastic with plastic impellers.

Filtering units are operated in conjunction with each recirculation system. These units consist of Eastern Industries, Inc., Model F stainless-steel pumps and Cuno micro-clean filters. These filtering units are connected between the pipes leading to the suction side of the recirculation pump and the machine side of the heat-exchange tank. Both the filtering lines and the recirculating lines are valved.

Filtering of the pre-bath solution differs from filtering the other solutions for here the full-flow system is used. The output of the recirculation pump is pumped through a large filter using shavings of polyvinyl chloride as a filtering medium. The unit has a clear plastic shell to allow visual inspection of the filter, with a by-pass valve arrangement for cleaning purposes. All valves and piping in the recirculation system are of red polyvinyl chloride. Rubber connections are placed in the lines to absorb vibration. Polyvinyl chloride tubing was found to be very easy to work with as it can be welded with a hot-air welding gun. We made elbows, T's, manifolds, and other fittings as the

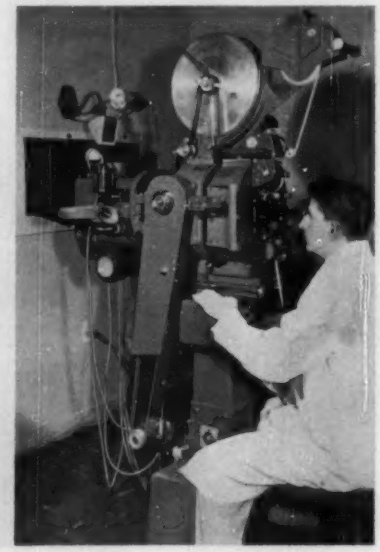


Fig. 14. Arri reduction printer.

situation demanded. A device was made which consisted of two infrared heat lamps, facing each other. The pipe was filled with sand and placed between the two bulbs on a small platform and then rotated. In a very few minutes the plastic became pliable enough to be bent.

Quality Control and Production

The chemical control section is located near the mixing room and standard laboratory equipment is used (Fig. 13). The sensitometric control of the process is at the present time located in our main building. A Herrnfeld sensitometer and a Western Electric color densitometer are used for this control. An intercommunications system is employed between the darkroom, sensitometric section, chemical mixing room, and the control desk in the light section of the developing-machine room to facilitate the operation.

Arri reduction printers are employed (Fig. 14). These are especially designed and incorporate fading mechanisms for printing from negative or positive. These are step printers, adapted for reduction, blow-up or contact. Provisions are made in the printer for scene-to-scene color balancing with the use of a cue strip. Track printing is done with standard Bell & Howell continuous printers running at 120 ft/min.

After the machine was set up and tested for transport of film, the sensitometric strips printed by us and those supplied by the film manufacturer were developed. The curves that we obtained on our first run were gratifying. The plots of all three layers, both the negative and positive, were parallel with no crossovers.

At the present time, the machine is in operation on routine production work, in 35mm negative, 16mm internegative and 16mm positive.

Acknowledgment

We would like to thank Arnold & Richter, Eastman Kodak Co., Ansco, Alsop Engineering, Hottel Engineering and Kling Photo Corp. for their fine cooperation and valuable assistance in making this entire installation one of the finest in the country.

Magnetic 16mm Single-System Sound-on-Film Recording Camera Equipment

By WALTER BACH, E. M. BERNDT, A. N. BROWN and R. L. GEORGE

A "single-system" camera method has been devised for simultaneously recording high-fidelity magnetic 16mm soundtrack lip-synchronized with an optical picture, for magnetic 16mm "single-system" sound recording of "live-pickup" reproduction quality, instant monitoring of the sound-track being recorded in the camera, together with greatly increased flexibility of picture-processing.

The ever-increasing use of 16mm sound-on-film in the television industry, as well as for educational and industrial films, has placed increased demands upon 16mm equipment. Particularly for TV newsreel work, where single-system soundtrack and picture are recorded in the camera on the same film at the same time, followed by fast film-processing and editing to exploit the "news" value, many difficulties are encountered in obtaining top-quality sound and picture because of the need for a compromise in film-processing somewhere between the ideal for soundtrack and for picture.

In many of the smaller film-processing laboratories around the country a good-quality negative or reversal picture can be obtained by visual inspection of test strips, but it is much more difficult for these laboratories to control gamma and density of optical soundtracks, especially on a "rush" newsreel basis. Also on a rush basis the picture sometimes can be processed conveniently only as a negative; it can then be reversed electronically and televised with very good picture results but with disappointing sound quality, as an optical soundtrack does not play back too well as a negative.

Now, with the advent of TV color film programming, it becomes even more important to do something about this continuing problem of picture vs. soundtrack processing which is facing 16mm sound-on-film TV newsreels, as well as other users of 16mm sound film who stand to benefit from improved sound and picture shot "single-system." Much has been said, written and even published in the past several years,* regarding improvements needed in 16mm TV newsreel filming techniques and 16mm sound-camera equipment, usually with the hope expressed that high-fidelity magnetic sound recording could be made use of, in order to process the single-system picture without any optical soundtrack processing problems.

With this in mind, the Berndt-Bach "Filmagnetic" equipment for single-system pre-striped magnetic sound-on-film was designed to make use in large part of existing Auricon 16mm optical sound-on-film recording cameras, which already incorporate a dependable filtered film-flow, are self-blimped for quiet running while recording sound, and take steady, professional pictures.

The Filmagnetic technique consists of pre-striping unexposed single-perforated 16mm picture film, in a photographic darkroom, with an ASA standard 0.095-in. wide magnetic stripe, identical with the stripe already used for 16mm magnetic projectors.

One of the outstanding advantages of magnetic pre-stripe is that the magnetic sound naturally requires no photographic chemical development after recording. In fact, the magnetic pre-stripe to be usable, must be impervious to the chemicals used for picture processing and it thereby provides the long sought-for opportunity of divorcing picture processing from the single-system sound record. For in-

Presented on May 3, 1956, at the Society's Convention at New York, by Walter Bach (who read the paper), E. M. Berndt, A. N. Brown and R. L. George, Berndt-Bach, Inc., 6900 Romaine St., Hollywood 38.
(This paper was received on October 19, 1956.)

* Spencer M. Allen, "Film problems in TV news reporting," *Jour. SMPTE, 64:* 413–415, Aug. 1955.

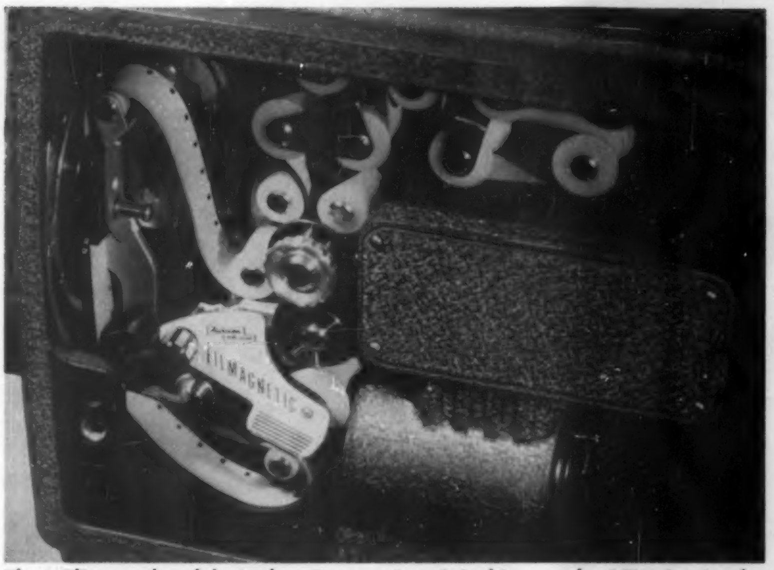


Fig. 1. Filmagnetic unit in Auricon Camera, threaded with pre-striped film, for shooting optical pictures with synchronized magnetic sound.

stance, some of the new fast films, such as DuPont 931-A and Eastman Tri-X, or Anscochrome color film, can be given special extended processing for best "existing light" picture-exposure results, without harm to the sound, if a pre-striped soundtrack is used instead of an optical soundtrack.

The Filmagnetic unit can be mounted in an Auricon optical sound-on-film recording camera. This twin-head unit has both record and monitor heads, so that the actual magnetic soundtrack being recorded inside the camera can be heard in the monitor headphones by the soundman.

If the Auricon Filmagnetic Camera is used for instrumentation recording instead of talking-pictures, the usual full track-width record and monitor heads could be replaced with two half-width record heads. This would enable the operator to record two individual half-tracks of high-fidelity magnetic information perfectly synchronized, for instance, with a motion picture of cathode-ray-scope displays.

By designing and rigidly standardizing the Filmagnetic Camera units for azimuth and easy interchangeability, one result has been that it is a simple matter after extensive use, to replace a unit having worn magnetic heads. Also, during the next several years when both optical and magnetic soundtracks may be in use for TV newsreels, the optional Filmagnetic system will provide a means of producing either optical or magnetic sound films in the same camera, with the least added cost for new camera equipment.

With pre-striped film threaded into the Auricon Pro-600 Camera and Filmagnetic unit, as shown in Fig. 1, a standard 28-frame separation between sound and picture is obtained. However, if a 24-frame separation is desired for use with some 16mm magnetic projectors, it can be obtained, as illustrated in Fig. 2. This threading diagram of the Auricon Pro-600 shows the threading path for conventional optical sound-on-film with the standard 26-frame separation of optical sound and picture. Also shown are alternate threading paths for 24- or for standard 28-frame separation of magnetic sound and picture.

Inasmuch as the TV newsreel industry has thus far indicated the most interest in magnetic single-system sound-camera equipment, the companion amplifier to be used with the Filmagnetic camera was "miniaturized" with the needs of the TV newsreel cameraman and soundman in mind. Figure 3 shows the Filmagnetic Model MA-10 Amplifier with its carrying case and shoulder-strap, weighing only 7 lb complete with case and self-contained batteries, and small enough for the soundman to "wear" over his shoulder.

Two high-gain 50 ohm microphone inputs are provided; there is also a high impedance phono input. The connecting plugs are of the professional locking type. All three inputs have individual volume controls, as well as an over-all "Speech-Music" switch which attenuates the lower frequencies in "Speech" position, for conventional dialogue equalization.

The top section of the amplifier can be opened for easy servicing. The lower section has a pushbutton opening latch for easy replacement of the self-contained batteries. Two mercury-type batteries are used, a 1½-v and a 67½-v, which will provide up to 50 hours of operation. For emergency use if mercury batteries are not available, a regular portable-radio 67½-v battery and a 1½-v flashlight cell can be used.

"A" and "B" battery test positions are furnished on the four-position selector switch. This switch also provides "Film

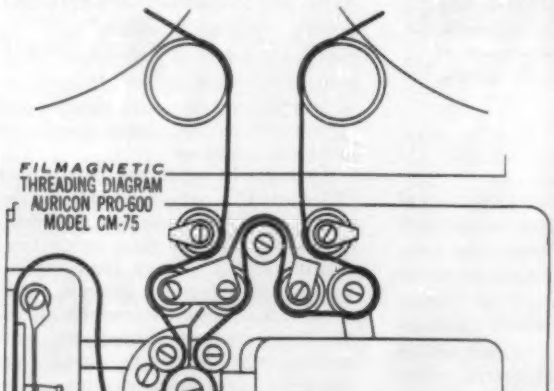


Fig. 2. Film threading diagram for Auricon Pro-600 Camera, Model CM-75, showing three alternate threading paths.

Monitor" and "Microphone Monitor" positions. On the "Film Monitor" position, the well-known monitoring advantages of magnetic recording are available with instant earphone monitoring of the actual just-recorded "Filmagnetic" sound-track inside the Camera. Only $\frac{1}{20}$th of a second delay occurs between the sound being picked up by the microphone and the same sound being reproduced from the magnetic soundtrack through the monitoring headphones.

With the selector switch on "Microphone Monitor," the headphones are connected to the microphone and recording amplifier output, to allow monitoring directly from the microphone, during rehearsals when the camera is not running and there is no magnetic soundtrack to "listen-in" on.

Figure 4 shows the Auricon Pro-600 Camera and Filmagnetic Amplifier ready to use. The equipment is designed for easy one- or two-man operation.

In conclusion, the Filmagnetic equipment makes single-system magnetic pre-stripe recording an optional feature easily added to existing Auricon optical sound-on-film recording cameras already in wide use, which should enable TV newsreels to conveniently explore the possibilities of magnetic pre-stripe recording. These possibilities include TV sound reproduction of filmed newsreel programs, the equal in sound quality and "presence" of a live-pickup show!

From the operations point of view, Filmagnetic pre-stripe recording can result in overall simplification of camera and amplifier field equipment and can also greatly simplify and standardize picture film-processing. With the advent of special Auricon magnetic studio re-recording equipment now under development, it should eventually allow "double-system" dead-sync or straight-across film cutting flexibility, with "single-system" editing speed and convenience.

Discussion

Jack Greenfield (Naval Photographic Center, Washington, D.C.): Do I understand that you're scanning on the convex side of the arced film?

Mr. Bach: That's correct.

Mr. Greenfield: Is the film supported under the scanning point?

Mr. Bach: Yes, it is.

Mr. Greenfield: What steps are taken to assure head contact?

Mr. Bach: The film being in a convex form wrapped around a roller, and the magnetic head under slight spring pressure, tend to flatten the film out. There is a little curl across the film usually, but when curving it around a roller the film cross-section becomes flat. The magnetic heads are carefully polished and run in, so that the contact is maintained.

Roger J. Beaudry (Shelly Films, Ltd.): What is the measured flutter on that?

Mr. Bach: It's half of one percent measured on a Herrnfeld Model 1501 flutter bridge.

Mr. Beaudry: What is the normal head life under these conditions?

Mr. Bach: We haven't worn one out as yet but we estimate it should last for about a million feet of film.

Mr. Beaudry: And is it a standard head or is it a special alloy?

Mr. Bach: It's a head that we designed and built ourselves, using special alloy steel. It's not a standard type head.

Chris Lankester (United Nations): During the transition period before the stations change over to magnetic sound, which they may do, do you find you have any demand for the possibility of optical and magnetic sound simultaneously? In other words, would it be possible to stripe a track on the outside of the sprocket holes and record simultaneously optical and magnetic?

Mr. Bach: Yes, you can do that. As a matter of fact, in the magnetic projectors used today, they stripe half of the soundtrack area with a magnetic stripe and record both a magnetic track and an optical track. The track you hear depends on which projector amplifier is turned on. This half-track technique can also be used with pre-striping. We can then record an optical soundtrack and a magnetic soundtrack in the same camera at the same time.

Richard Norton (Warner Pathe News): I wanted to ask one question with relation to the intimate association of the pickup head to the record head. While you're recording, when you're listening on a pickup head, how much isolation is there between the two heads, in decibels? Is there any background echo?

Mr. Bach: We have about 40-db isolation between the two heads—obtained with careful shielding and amplifier design.

Mr. Norton: Without having to go to a slide rule, how many mils separate the gaps between the pickup and the record head? What's the spacing between both those heads?

Mr. Bach: I think I mentioned a twentieth of a second. The separation is just a little over a frame of film, and at 24 frames/sec it works out to be a twentieth of a second delay between record and reproduce.

Mauro Zambuto (Transound, Inc.): How many cables are connected to the camera?

Mr. Bach: There's one power cable going to the camera to drive the camera motor, and another cable that goes from the amplifier to the camera.

Dr. Zambuto: And of course there would be a third cable going from the microphones to the amplifier?

Mr. Bach: Yes, there would be a cable from the microphone to the amplifier.

Dr. Zambuto: Are you producing at all, or do you intend to produce, a camera without the optical sound attachment—in other words a camera to record exclusively magnetic sound?

Mr. Bach: Yes, we now furnish the Auricon camera with magnetic only, without optical

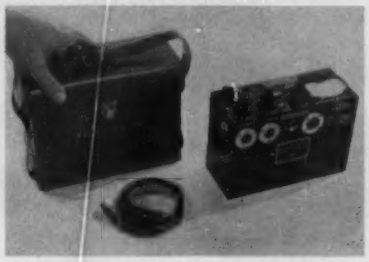


Fig. 3. Auricon Filmagnetic Model MA-10 Amplifier with carrying case.

Fig. 4. Auricon Filmagnetic Amplifier and Camera ready to use.

sound, or as a picture-taking camera only without any sound recording in it. Then you have the privilege of putting in optical or magnetic sound, any time you like.

Dr. Zambuto: Would this affect the weight considerably or not?

Mr. Bach: If you take the optical out of the camera you save about 2 lb on the camera.

Dr. Zambuto: And the total weight of the camera with blimp is—?

Mr. Bach: The Cine-Voice 100-ft camera weight is 12½ lb. All these cameras are self-blimped. The Pro-600 weighs about 26 lb depending on the magazine and so on. The Super-1200 is 32 lb. Actually the Filmagnetic unit in the camera weighs only a few ounces—you can't tell whether it's in or out, as far as the camera weight is concerned.

Joseph Tanney (S.O.S. Cinema Supply Corp.): We assume that any Auricon camera now in the field can be converted to the Filmagnetic system?

Mr. Bach: That's correct.

Mr. Tanney: What is entailed there?

Mr. Bach: We have to install shielding in the camera to keep the motor fields away from the monitor head, and rearrange the wiring in the camera for the elimination of hum pickup. We also replace the ordinary pressure roller that's under the sound recording sprocket and the shaft that supports it with a special keyed shaft which will take the two Filmagnetic units interchangeably. It's a simple factory installation.

George Lewin (Army Pictorial Center): Have you had any experience or any complaints that the magnetic stripe has any abrasive effects on the camera gate with long running?

Mr. Bach: The magnetic stripe is facing the back pressure plate which is heat-treated stainless steel. We haven't been able to discover any wear on the back pressure plate. Also, the back pressure plates are easily replaced, when necessary. You can change the pressure plate in half a minute without tools and if there were any wear, we would install sapphire pads there to eliminate the wear, sapphire being harder than the magnetic stripe.

Edgar A. Schuller (De Luxe Laboratories, Inc.): Is there a switch which will permit selecting the sound from the magnetic amplifier or the sound from the optical amplifier to feed into the camera? What determines whether the sound should go to the magnetic record head or to the galvanometer?

Mr. Bach: We've replaced the regular 5-pin connector which ordinarily feeds sound into the camera for optical recording, with a 9-pin connector. We use one set of 5 pins for the optical galvanometer and a different set of 4 pins for the Filmagnetic. Whichever amplifier you have plugged into the connector on the camera determines the unit inside the camera which will be operating.

Lighting for Color Opaques on Television

By H. N. KOZANOWSKI

The use of 3-V Film Cameras to provide high-quality color TV reproduction of color opaques has brought new requirements for lighting sources. These must cover uniformly a limited field at light levels of the order of 10,000 ft-c. Such levels are currently in use for monochrome TV reproduction of opaques. Various methods of obtaining adequate illumination for color are compared.

Many broadcasters have expressed the need for reproducing colored opaques and actual products in addition to the usual color film and 2 × 2 in. color slides. The advantages of such possibilities are: color art copy can be prepared without too much difficulty, last-minute changes can be introduced and much of the current advertising material for spot commercials is already available in a suitable size in current magazine advertising. The matter of optimum copy size is still subject to many opinions. However, there is almost unanimous agreement that the 3 × 4 in. scanned area commonly used for monochrome opaque pickup is too small to be useful in preparing original artwork.

3-Vidicon Film Chains and Opaques

We have found that it is entirely practical to provide an optical system with a large effective aperture for use with the 3-V (three-vidicon) film chain. This permits the pickup of color opaques at the same order of light levels as is now used for monochrome opaques. The optical system, shown schematically in Fig. 1, provides a standard-sized image at the 3-V film-chain field lens which is treated exactly like the picture from any of the other sources in the system. The color fidelity and general picture quality obtained with this arrangement are excellent, and no compromise whatsoever is made with the standard performance of 3-V for color film and color slides. A tentative working area of $7\frac{1}{2} \times 10$ in. has been proposed, although any size of copy can be used with the new optical system merely by refocusing the taking lens.

Discussion of Fidelity

The excellent 3-V results which are observed are rather easily explained. An opaque color print which is selected as pleasing to the eye, has good skin tones, is flat-lighted, uses bright saturated colors, and has an ideally controlled range from lowlights to highlights which is introduced by the color printing process itself. This range in color printing seldom exceeds 15 or 20 to 1. All of these factors are precisely those which are required to produce good color film and slides for television. In addition, modern techniques of maintaining color-print quality control the maximum and minimum reflectance in the prepared copy within narrow limits. Consequently, there is very little need to readjust levels in a sequence of opaques taken from current advertising material.

Live Commercials

From opaques reproduced with 3-V, it is a very small step to "live commercials" which can show the actual product in color directly with action shots such as pouring beer, soda, opening packages, etc. Since the taking lens arrangement is basically the same as with the image-orthicon color camera, the depth of field and the ability to focus to a selected size are both quite adequate. In the opinion of some broadcasters the ability to do these live or animated commercials may prove to be much more important to the broadcaster than the ability of reproducing color opaques alone.

Approach to Lighting

The proposed copy size of $7\frac{1}{2} \times 10$ in. represents a choice which is attractive from the standpoint of available copy, and allows the original artwork to be done with comparative ease. However, since the optical system is flexible, copy of 18 × 24 in. size (30 in. diagonally) has been successfully used. For the $7\frac{1}{2} \times 10$ in. size, we originally used 1-kw projectors of the professional type to illuminate the subject matter. Each one of these can furnish collimated light on this area at a level of about 8,000 ft-c using a $f:2.3$ standard lens. Thus, 16,000 ft-c incident on the subject can be obtained using two of these projectors suitably placed, with very little light splatter and with excellent heat filtering. Even at these light levels, with Aklo heat filters built into the projector system, and with the forced ventilation available in the projector itself, it is possible to obtain light levels, on the scene, of about 16,000 ft-c with very little associated heat. However, initial projector cost and the lamp operating costs are both quite high.

For laboratory use it was possible to design a stripped-down version of a 1-kw projector, containing only the lamp, a suitable condenser system and a blower. This projector showed excellent performance, appeared to be economical to build, but was commercially unavailable.

Further investigation showed that it was possible to provide adequate and economical lighting for color opaques by

Presented on April 30, 1956, at the Society's Convention at New York by H. N. Kozanowski Commercial Electronics Products, Radio Corp. of America, Camden 2, N.J.
(This paper was received on August 17, 1956.)

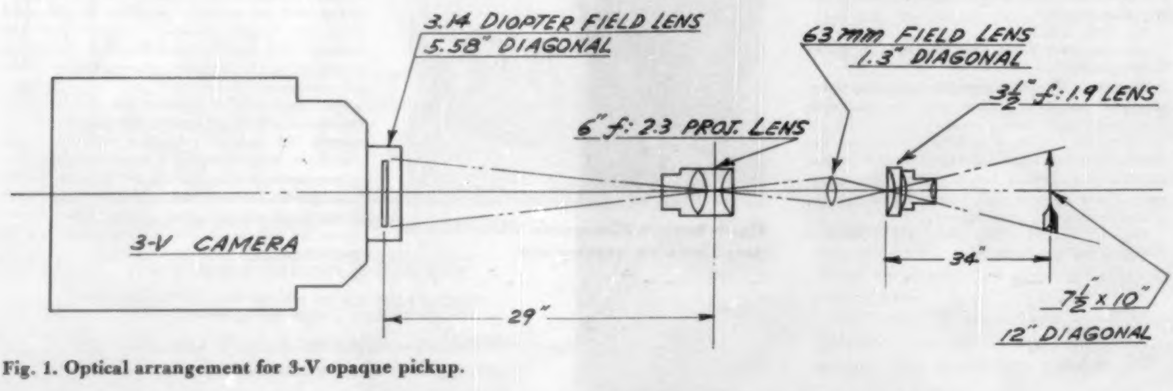


Fig. 1. Optical arrangement for 3-V opaque pickup.

using photoflood lamps of the PH-375/34R4 type to provide a very economical source of illumination. These lamps were arranged in the standard swivel sockets with attached infrared cut-off filters. (In this case Pittsburgh 2043X, 7mm thick reduces the transmission at 10,000 A to 1% of the incident radiation.) Below each of these triple banks of photoflood lamps is located a standard 10-in. electric fan which serves to circulate air over the infrared absorbing glass and keep its temperature to a reasonable value. In this way, high lighting levels can be obtained with very little heating effects. An arrangement of such photofloods illuminating an opaque is shown in Fig. 2.

The use of photofloods can be easily justified for this type of operation since they can be connected to operate at reduced voltage during stand-by conditions, and can be keyed by means of a magnetic amplifier Variac or other circuit to operate at rated voltages during the periods in transmission when full lighting level is required. It is seldom necessary to provide a commercial picture for longer than 30 or 40 seconds for "on the air" use. Since most lamp failures occur due to thermal shock during turn-on, and not usually as a result of filament burn-out, this keying arrangement allows one to use such photoflood lighting sources. These are efficient, inexpensive, and have a comparatively long working life.

As previously mentioned, the variation in highlight and lowlight reflectance characteristics from opaque to opaque in color is relatively small. However, even this small amount of variation can be taken care of by using the magnetic amplifier as a voltage control on the photoflood lamps themselves to vary within limits the amount of lighting incident on the scene. In such a way one can obtain constant peak-to-peak video signal level from the chain. Because of the narrow range of adjustment required, the color temperature shift introduced by this procedure has been found entirely negligible.

The same lighting technique has been applied to "live commercials" which were previously described. In fact, the use of the six photoflood lamps arranged in suitable swivel mounts allows a very desirable amount of flexibility in lighting and in minimizing specular reflection from highlights. Collimated light as provided by single-lamp 1-kw projectors is harder to handle for satisfactory illumination of "live" subjects.

Fig. 2. Photofloods illuminating an opaque.

Conclusion

The application of a newly developed optical system to 3-V color-film reproducing equipments, makes it possible to reproduce high-quality opaques and "live" subjects. This represents a major step forward in television color programming since it allows the broadcaster to produce high-quality spot commercials, preceding and following color shows, with currently available equipment. Preliminary checks on this method, together with broadcasters' field reactions, indicate that this method of reproducing opaques may have far reaching importance in color television broadcasting. Photoflood lamps suitably enclosed and positioned allow the broadcaster to provide efficient, economical, and long-life sources having the required flexibility to open up a wide range of commercial and programming possibilities.

Discussion

Anon: Are there any problems with absorption in Kodacolor prints?

Dr. Kozanowski: From the standpoint of color temperature, or actually of heating or buckling?

Anon: No, color rendition alone.

Dr. Kozanowski: If you shift illumination color temperature toward the blue, for example by using Aklo filters (infrared absorbing) you may have to readjust the system, but actually the system is very tolerant of color temperatures anyway. Further, in answer to your question, we ran some tests with Eastman on 16mm copies of the original SMPTE color test print — one of which is built or exposed for incandescent projection, and the other one for arc. The question asked was, which do you like better? Well, it turned out, we don't much care, because, with a slight rejuggle of blue and green video gains you are back at the reference starting point.

Sholom Rubinstein (Advertisers Broadcasting Co.): Have you ever found that inks or dyes that went into the making of a package could act strangely on a system? In other words, do they have to be color-corrected as is done with a black-and-white package?

Dr. Kozanowski: In the case of opaques or actual packages, we have run into no particular problem because if it looks good to the eye it will come out through the system, looking about that good. There may be small changes. But basically when we get into recording on film then you may run into traps because actually when you go into colors that have high saturation they may have low luminance. One example that occurs to me is the Lucky Strike cigarette package, which has a red bull's eye in it. But that red bull's eye photographed normally will reproduce practically jet black in a television system. So you have to soup it up with higher reflectance colors to make it come out right. Basically though, this opaque pickup works very much better. Let's put it this way: we have yet to make it do tricks that we can't explain.

Revision of American Standard PH22.40, Photographic Sound Record on 35mm Prints

A proposed revision of American Standard Z22.40-1950 is published here for a three-month period of trial and criticism.

This proposal differs from the 1950 standard in both form and content. With respect to form:

1. The title is shortened.

2. A new diagram is substituted to improve its clarity.

3. A limiting scope, formal numbered specifications, a table of dimensions and an explanatory appendix are added.

As to content:

1. The picture-sound separation is given as exactly 21 frames as a print specification and as approximately 20 frames as a projector threading specification.

2. Dimension B, the inner edge of the printed area, and dimensions D and F, the centerline of the sound records and scanned area, are increased by three mils and one mil respectively to bring these dimensions into accord with international standardization.

3. The paragraph relating the specified dimensions to unshrunk raw stock is deleted as an irrelevant variable.

4. The scanned area height specification is deleted on the grounds that the scanning height does not insure standardization of reproducers with respect to their output level or frequency response.

Criticism and comments concerning this proposal should be sent to Henry Kogel, SMPTE Staff Engineer, prior to February 15, 1956. If no adverse comments are received, this proposal will then be submitted to ASA Sectional Committee PH22 for further processing as an American Standard.—H.K.

Proposed American Standard

Photographic Sound Record on 35mm Prints

PH22.40

Rev. Z22.40-1950

Page 1 of 2 pages

1. Scope

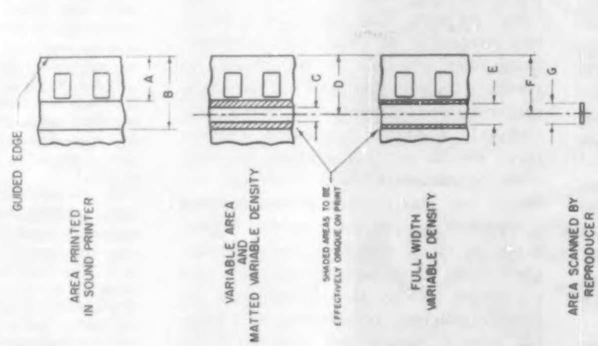
1.1 This standard specifies the location and dimensions of variable area and variable density sound records for the photographic printing of sound on 35mm sound motion-picture prints. The area scanned in the sound reproducer is also specified.

2. Dimensions

2.1 The dimensions and location of the sound record shall be as specified in the diagram and table.

2.2 The sound record as printed on the film shall be displaced from the center of the corresponding picture by a distance of 21 frames in the direction of film travel during normal projection.

2.3 When the sound record is reproduced, the distance from the center of the projector aperture to the sound scanning point shall be adjusted to bring the picture and sound into synchronism for the average observer. Usually this separation will be twenty frames, and this will provide synchronism for an observer at a distance of fifty feet from the speaker.



Dimension	Inches	Millimeters
A	0.192 ± 0.001	4.88 ± 0.03
B	0.308 ± 0.002	7.82 ± 0.05
C	0.076 ± 0.001	1.93 ± 0.03
D	0.244 ± 0.002	6.20 ± 0.05
E	0.100 + 0.000 − 0.008	2.54 + 0.00 − 0.20
F	0.244 ± 0.001	6.20 ± 0.03
G	0.084 ± 0.001	2.13 ± 0.03

NOT APPROVED

Page 2 of 2 pages

APPENDIX

The picture-sound separation is specified in Section 2 in two different ways:

1. For laboratory printing—21 frames
2. For projector threading—20 frames

This seems to imply that the printing operation establishes the 21-frame separation, but this, in fact, is not so. The printer adds a 20-frame separation to an existing one-frame differential.

The one-frame difference results from the fact that editorial or "in-line" sync (picture and corresponding sound aligned side by side) is changed by one frame to accommodate the mixer in a rerecording studio where the mixing console is approximately 50′ from screen and speaker. Under normal conditions, sound travels about 1100′/second and thus 45-50′ during the 1/24 second that a frame is in the projector aperture. The sound at the speaker is thus one frame, in time units, ahead of that same sound at the mixer's position. The mixer, to adjust for sync at his location, automatically calls for a one-frame increase.

In the projector, a 21-frame threadup separation will bring corresponding picture and sound to the screen and speaker at the same instant; a 20-frame threadup separation produces this synchronous condition about 45′-50′ from the screen; a 19-frame threadup separation results in synchronism at about 90′-100′ from the screen. Consequently, the projectionist in a drive-in theater will thread 21 frames since the speaker is within a few feet of the patron; in a theater of moderate size, he will thread 20 frames and in a very large theater, he may thread 19 or 19½ frames.

NOT APPROVED

news and reports

80th Convention

Heavy attendance at all technical sessions, the equipment exhibit and the social activities at the Ambassador Hotel in Los Angeles, October 8–12, is a good measure of the success of the Society's 80th Convention. Much of the credit for this is due to the advance planning of the local SMPTE members who devoted much time, long before the convention officially opened to making certain that all would run smoothly.

Initial arrangements were begun more than a year ago by Convention Vice-President Byron Roudabush, who selected the members of the local arrangements committees. Actual on-the-spot direction fell to Ed Templin, Local Arrangements Chairman, who supervised pre-convention planning and the day-to-day arrangements of the meeting.

Program and Exhibits

The extensive papers program was organized by Petro Vlahos, assisted by five topic chairmen: Merle Chamberlin, Projection and Viewing; Frank Gaskins, Television; Bill Gephart, Laboratory Practice; Kurt Singer, Transistors; and Roy Wolford, Instrumentation and High-Speed Photography. This group assembled 66 papers into 15 technical sessions, running from Monday afternoon through Friday evening. In addition to the technical papers the committee arranged for demonstrations of the Du Mont Electronicam Film System, the MGM 65mm System, and 6-channel stereophonic sound as well as a tour of the NBC Burbank color TV facilities and an all-day field trip to the U.S. Navy Electronics Laboratory at San Diego for a group interested in high-speed photography. Two of the technical sessions were devoted entirely to papers on transistors — a full-scale initiation of this subject before the SMPTE. Attendance at sessions averaged 150, ranging from 40 at one session, which was running late, to as high as 300 at the Monday Evening Session at the NBC Television Studios and at the Thursday Evening Session when Ralph Evans demonstrated and spoke on "Sharpness and Contrast in Projected Pictures" and when the Ampex Videotape Recording System was given its first technical description. Other sessions of unusually high attendance were the Laboratory Practices Sessions on Tuesday; the High-Speed Photography and Sound Sessions on Wednesday morning; and the Transistor Sessions.

The motion-picture short subjects which introduced each session were gathered and arranged by Ted Fogelman.

An equipment exhibit, featuring displays of the latest film laboratory and motion-picture and television studio equipment, was held in conjunction with the convention. Exhibit preparations were made by John Olsson, assisted by Craig Curtis. The equipment, displayed in 29 booths, represented the products of 22 exhibitors.

Registration

At the last convention held in Los Angeles in 1954 registration was 926. That figure was surpassed somewhat at the 80th where total registration was 1038. Broken down, the figures indicate that 561 members registered for the week, 115 by the day, 30 non-members registered for the week, and 155 by the day. The Ladies Program had 89 participants. There were 88 registrations issued to exhibitors. A geographical breakdown indicates that registrants came from 29 states and the District of Columbia as well as Belgium, Canada, France, Hawaii, Italy, Japan and Mexico. Responsible for the difficult and time-consuming task of directing registration was Charlie Handley, who was efficiently aided at the cash box and with registration records by auditors H. J. Herles and Arthur Johnson. Because of their efficient operations, the usual registration confusion was held to a minimum.

Hotel arrangements were under the direction of Bob Hufford. Delegates who had attended the previous meeting at the Ambassador were pleased to find that the meeting rooms, committee rooms and exhibit area had recently been remodeled to provide more comfortable and convenient convention quarters.

Luncheon

The convention was officially opened on Monday at the Get-Together Luncheon which was arranged by Carl Hunt. It was attended by 360 who were treated to three challenging and interesting speeches. Dr. Frayne gave résumé of views of current industry conditions. His luncheon address appears earlier in this issue of the *Journal*.

Following the address of President Frayne, George Sidney, President of the Screen Directors' Guild, urged members of the SMPTE to look into the problem of improving projection and sound conditions in motion-picture theaters. Mr. Sidney stated that because most motion-picture theaters were never built for current technical developments, the majority of the public does not see motion pictures as they were conceived by engineers and producers.

Mr. Sidney also offered a challenge to the engineers by suggesting they seek solutions to six production problems encountered daily. These include the need for smaller, more flexible equipment, directional sound, less cumbersome lighting equipment, less heat on the set, standardization of production equipment and a standardized looping system.

The final luncheon speaker introduced as Dr. Hoffman, a distinguished engineer from abroad, proved to be an entertaining surprise with his description of an amazing new system called Vunderscope which "delivers stereoscopic images without glasses, stereophonic sound without horns, in full natural color (using black-and-white film). It uses only one single celluloid strip and is 69mm film." The inventor of this marvelous new process, for which investment shares were readily available, then advised his audience that if he had insulted anyone he was grateful for the opportunity and revealed himself as the actor, Vince Barnett.

Banquet

The traditional banquet was held on Wednesday evening in anything but a traditional manner. The cocktail party took place around the pool and the 601 who attended this and the banquet which followed were treated to a water ballet and diving exhibitions made possible through the courtesy of General Film Laboratories. Following the aquatic activities guests adjourned to the Coconut Grove for a Hawaiian lauau complete with roast pig and exotic Oriental dishes. There were leis for the ladies, entertainment by a Hawaiian group, and dancing to the music of Freddy Martin's orchestra. The major entertainment was supplied by the unusual dance team of Chiquita and Johnson and the famous operatic star, Margueritte Piazza. Banquet arrangements were most ably handled by Alan Gundelfinger and entertainment arrangements were made by Sid Solow. To them SMPTE members are grateful for a pleasant and unusual banquet.

With several tours and demonstrations held away from the hotel and the ladies visits to points of interest around Hollywood, the hospitality and transportation desk was kept busy arranging for buses and dispensing information and SMPTE literature. Ted Grenier, undaunted chairman, assisted by Betty Hartlane of ABC and a group of studio pages, managed to head everybody in the right direction and on time, too.

The Membership Committee was also on hand with application blanks and descriptive literature. Under the direction of Harry Lehman, Western Regional Membership Chairman, the committee signed up 25 new applicants and dispensed quantities of application blanks and membership information to interested prospects.

The extensive papers program kept the projection and public address and recording committees at their tasks almost continuously throughout the week. Bundy Smith and his crew of IA projectionists

did a find job with the multitude of slides and motion pictures; and Jim Pettus and John Stork handled the public address and recording duties in a most helpful manner.

With the excellent facilities of the Ambassador Press Room at their disposal Marty Waldman, Sue Grotta and Mrs. Alan Gundelfinger fed quantities of inform a on the program to the trade papers, wire services and Los Angeles dailies. Interviews with many of the speakers provided the press boys with additional timely stores on industry developments.

Always available to lend a hand where needed was Administrative Assistant Herb Farmer.

For the ladies the program included a trip to Disneyland, tea at the Beverly Hills Hotel and lunch and a tour of the Warner Bros. studios in Burbank. Arrangements were made by co-hostesses Mrs. John G. Frayne and Mrs. Norwood Simmons.

One of the most important events of the convention was the 1956 SMPTE award presentation ceremonies. The planning and coordination of arrangements for this session were done by Eric Howse. The citations and awards are published in a separate story.—*S.G.*

Society Awards

One of the high points of this and every Fall Convention is the Awards Session. One of the most rewarding obligations of the Society as a whole is that of selecting from its members those who are most deserving of the special recognition embodied in the awards granted for outstanding achievements within particular categories.

The 80th Convention's Award Session, October 9, 1956, was, in many respects, a solemn occasion. The David Sarnoff Award was granted posthumously to Robert E. Shelby and Honorary Membership was granted to the then gravely ill Dr. Alexander Ernemann whose death occurred five days later (obituary p. 621). The Award was accepted in his absence by his friend, Dr. Eduard S. Schneider, German Consul General for Los Angeles. The posthumous Award to Robert E. Shelby was accepted by his widow.

Honorary Members

Dr. Eduard C. Schneider, German Consul General for Los Angeles, accepted the Award Certificate for Dr. Alexander Ernemann. The name of Dr. Ernemann, who died October 14, will be added to the Society's Honor Roll. Loren L. Ryder read the following citation:

This is one of the greatest honors that this Society can bestow upon a man and once so honored, this honor stays with him through life.

While most of us in the United States are familiar with the developments which have originated in our country, the record shows that much of the development work in motion pictures took place on the other side of the Atlantic.

Today we are honoring a man who can look back and recall clearly the introduction of motion pictures. His age is 80. His home is in Stuttgart, Germany. Independently of the early work which was done in motion pictures in the United States, he developed one of the first motion-picture projectors. Through the years he has continued to design and develop projectors through Stahl Projector to today's Ernemann X. Dependability, performance and fine workmanship have given Alexander Ernemann an excellent reputation in the industry. He developed the first projector with enclosed gears and full lubrication. He was also the first to use air and water for cooling.

Dr. Ernemann's achievements will live forever and we of the Society are happy that we can honor him today.

Fellows

Herbert Barnett, Chairman of the Fellow Awards Committee, presented Award Certificates with the following citation to the sixteen members who were given the grade of Fellow:

One of the more satisfying responsibilities within the Society is assigned to the Fellow Award Committee. It is through this committee and by approval of the Board of Governors, that members of this Society are elevated to the grade of Fellow.

To achieve this distinction one has, by his proficiency and contributions, attained to an outstanding rank among engineers or executives of the motion-picture or television industries. Each year the Committee, composed of all the Society Officers, Section Chairmen and Chairmen of all engineering committees carefully examines candidates' names compiled from nominations emanating from many sources. Recommendations are then passed to the Board of Governors who approve, modify or expand the selections arrived at by the Committee.

Again, this year we have a distinguished list of engineers and executives whom, I am sure, you will agree are well worthy of this honor. I take pleasure in announcing the names of those achieving grade of Fellow for 1956:

Willy Borberg	Fred Hynes
Jasper S. Chandler	Warren R. Isom
John W. DuVall	Walter I. Kisner
Edward Furer	Frank L. Marx
Edouard P. Genock	John B. McCullough
Herman M. Gurin	Richard O. Painter
Wilton R. Holm	Michael Rettinger
Robert G. Hufford	John G. Streiffert

Progress Medal

In the absence of Dr. Otto Sandvik, Chairman of the Progress Medal Award Committee, Gordon Chambers read the citation. Presentation was made to Barton Kreuzer who accepted on behalf of the recipient, Dr. Alfred Norton Goldsmith who was unable to be present. Mr. Kreuger read Dr. Goldsmith's acceptance speech:

The Society of Motion Picture and Television Engineers has selected Dr. Alfred Norton Goldsmith as the recipient of its Progress Medal Award for 1956.

The Progress Medal is being awarded to Dr. Goldsmith for his many contributions to the progress of many phases of sound motion-picture and television engineering, particularly for his early recognition of the importance of a tricolor kinescope and his concept of means for accomplishment.

Dr. Goldsmith was graduated from the College of the City of New York with a Bachelor of Science degree. He received his Doctor of Philosophy degree in science from Columbia University where he studied under the eminent scientist, Professor M. I. Pupin. Later he received honorary Doctor of Science degree from Lawrence University.

Since his early academic career at the College of the City of New York, where he became Professor of Electrical Engineering, Dr. Goldsmith has held many prominent positions in the industrial field.

He has been active in research and invention and over two hundred patents have been issued to him, including the very basic patent on the aperature mask phosphor-triad color kinescope tube.

Dr. Goldsmith continues to be active in motion-picture and television engineering and is a Past-President of SMPTE and IRE.

He is a fellow of many learned societies including the SMPTE, the IRE, the American Institute of Electrical Engineers, and the American Physical Society. He has received many awards including the Medal of Honor and the Founders Award of the Institute of Radio Engineers, the National Pioneers Award and The Radio Pioneers Award.

For his contributions to the science and technology of sound motion-picture and television engineering, Dr. Alfred Norton Goldsmith is awarded the Progress Medal of the Society of Motion Picture and Television Engineers.

Acceptance Address for Progress Medal Award

There are good reasons why I should regard this meeting as a highlight occasion for me. It includes, in fact, a rare combination of what I may paraphrase as "the time, the place, and the Society." The time is one when the video and audio arts and sciences are fully blossoming, to the great satisfaction of those of us who have been privileged to be workers in so luxuriant a vineyard. The place is this great Metropolis of the Pacific which saw the birth, growth and fruition of the recorded picture in motion. And the Society is one which has fittingly grown and prospered together with the industries which its membership have so capably served and developed.

Seldom, in fact, could there have been so happy a combination of accompanying circumstances as that which marks my presence before you today. And this is particularly so since I have had the honor in the past of acting as the President of this Society, and as a Board and Committee member and chairman for many years. Most appropriately, I wish first to express my deep gratitude to the Awards Committee and to the Board of Governors which have conferred a great honor upon me. And I am pleased that the Progress Award has been granted to me for so wide and varied a group of contributions in the several fields of engineering in which this Society is active.

Yet this occasion would not be complete nor pertinent implications clear unless I emphasized one particular aspect of the conditions surrounding this Award—namely, that dealing particularly with the

invention of the basic tricolor picture tube. In this regard, I feel an extremely close unity with a group of splendidly ingenious and tenacious scientific workers and inventors in the Radio Corporation of America who were responsible for the actual physical embodiment of the color kinescope and who repeatedly showed most unusual resourcefulness and capability in planning, devising, designing, developing and commercially producing this complex final product. For them I here gladly express great admiration and esteem. And I take this welcome opportunity to pay tribute to some of their representative leaders individually, though with necessarily brief mention of their outstanding accomplishments. These leaders then include:

A. C. Schroeder, who suggested the use of a triple gun in conjunction with a shadow mask, the three beams being deflected by a single deflecting system;

H. B. Law, who experimentally verified and extended the principles of operation of the tube, developed its basic technology as a whole, and constructed the first working model;

H. Rosenthal, who developed the silk-screening technique for deposition of the phosphor dots;

E. W. Herold, who organized exploratory work on numerous types of color kinescopes leading to the decision to adopt the shadow-mask type;

D. W. Epstein, who was active in the colorimetric and electron-optical aspects of the tube, and led the applied research on it;

D. D. Van Ormer and *Miss H. C. Moody*, who worked out the engineering design of the tube; and

In the color Kinescope Operations Department, *H. R. Seelen*, manager; *C. P. Smith*, Chief Engineer; and *K. M. McLaughlin*, Plant Manager, who jointly constituted the team responsible for the institution and management of high-efficiency mass production of color kinescopes.

Let me again thank those in this society who have so generously recognized my various contributions. And may I assure them that this Award will, as it should, strongly stimulate me to renewed and enhanced effort over the years.

Journal Award

In presenting the Journal Award, Armin Hill, Chairman of the Journal Award Committee, read the following citation. Acceptance was made by Axel G. Jensen on behalf of Donald G. Fink:

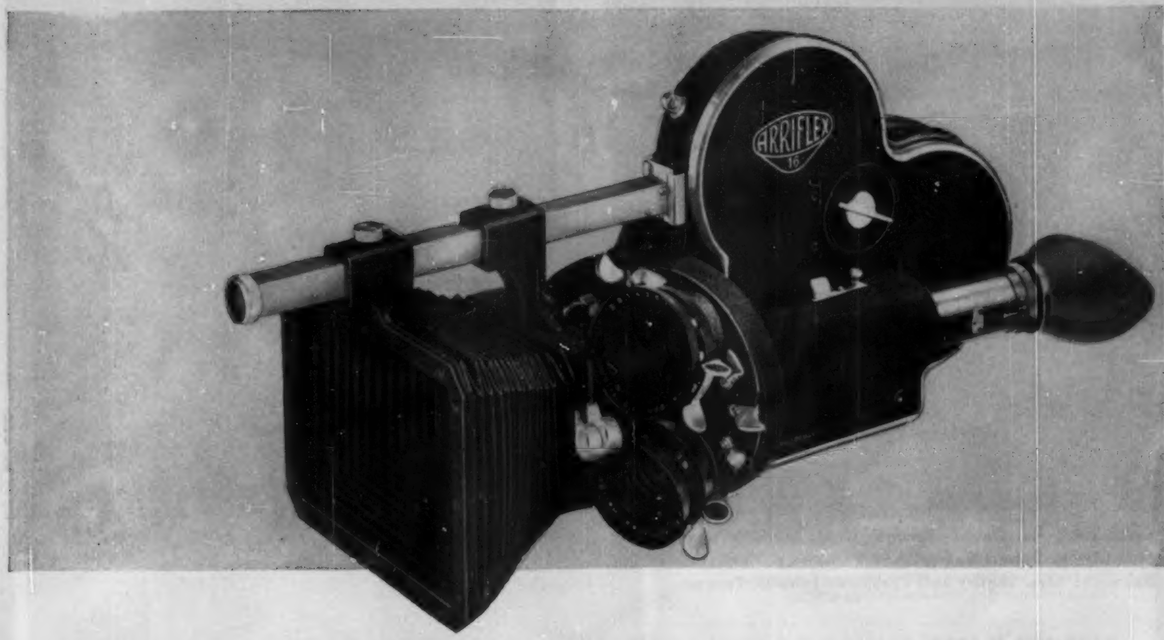
On behalf of the Journal Award Committee and the Board of Governors of the Society of Motion Picture and Television Engineers, I am pleased to announce that the award for the outstanding paper originally published in the *Journal* of the Society for the year, 1955, is made to Donald G. Fink, Director of Research of the Philco Corporation, for his excellent paper, "Color Television vs. Color Motion Pictures," published in the June 1955 *Journal*.

Mr. Fink is well known for his activity in several fields, particularly those involving electronics and television. A graduate of the Massachusetts Institute of Technology and of Columbia University, he has served on the editorial staff and as Editor-in-Chief of *Electronics*, as Editor of the Proceedings of the National Television System Committee, and since January 1956 as Editor of the *Proceedings of the Institute of Radio Engineers*. He has served as a member of several important national and international committees in radio and television work, and has been particularly active in standardization work in these fields. As Director of Research for the Philco Corporation he now administers research activities in radio, television and electric appliance fields.

His interest in color television stems, of course, from his long professional association with problems in that field, though he claims that his interest in color motion pictures is purely an amateur one. When he wished to make a fair comparison of these two media, he found so much essential data lacking that he undertook his own study. He was so successful that when his associates saw the results, they pressed him to prepare his material for publication in the *Journal*.

Papers for this award are selected on the basis of technical merit and importance of subject matter, originality and breadth of interest, and excellence of presentation. This paper rated very high in each of these categories in the opinion of each committee member. Especially, however, the committee felt that the readable, informal style of presentation made it an outstanding contribution, well worthy of this award.

Papers selected by the committee and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Presentation of David Sarnoff Gold Medal Award, posthumously, to Robert E. Shelby: T. Gentry Veal, Committee Chairman; Mrs. Shelby and President John G. Frayne.

William Mueller, Chairman of Samuel L. Warner Memorial Award Committee; C. C. Davis, Award winner; and President John G. Frayne.

approved by the Board of Governors for honorable mention are:

"Effect of Nitrogen Oxide Gases on Processed Acetate Film" by J. F. Carroll and John M. Calhoun, this being a well prepared and presented report on a very important aspect of film storage;

"Image Analysis in Photographic and Television Systems" by Otto H. Schade, a most timely and important paper in a series which gives a revolutionary approach to many of the problems of image transmission; and

"History of Sound Motion Pictures" by Edward W. Kellogg, a most valuable and comprehensive series of articles on the development of this important phase of motion-picture technology.

David Sarnoff Gold Medal

The 1956 Sarnoff Medal was awarded posthumously to Robert E. Shelby. Presentation was made to Mrs. Shelby by T. Gentry Veal, Chairman of the David Sarnoff Gold Medal Award Committee, who read the following citation:

On December 8, 1955, Robert E. Shelby died unexpectedly of a heart attack. Although death has deprived us of a very dear friend and associate, Mr. Shelby was chosen by his colleagues in the television industry to receive posthumously the David Sarnoff Award of this Society.

Mr. Shelby was born in Austin, Texas, on July 20, 1906. He was graduated from the University of Texas, where he received the degree of Bachelor of Science in Electrical Engineering, and a Bachelor and Master of Arts.

Mr. Shelby had a close interest in radio for 35 years and was actively engaged in television work for 24 years. He joined the National Broadcasting Company in 1929 after graduation from the University of Texas. In 1931 he was placed in charge of NBC's first experimental television installation on top of the Empire State Building. Among the positions he subsequently held with NBC were Director of Technical Development and Director of Technical Operations for the television network, and Director of Color Television System Department. In July of 1954, he was made Vice-President and Chief Engineer of NBC.

In the early days of black-and-white television, Mr. Shelby devoted much of his time to industry committees. This work eventually led to the adoption of the present signal specifications for commercial television. Similarly, Mr. Shelby played an important role in the formulation of the signal specifications for compatible color television which were eventually adopted by the Federal Communications Commission. He was a Fellow of the Institute of Radio Engineers, a Fellow of the American Institute of Electrical Engineers, and held a Fellowship in this Society which he received last fall at Lake Placid.

Mr. Shelby is the author of many technical articles and is the holder of many U.S. patents, the most notable being that concerning an electronic modulator for constant-frequency variable dot transmission.

Mr. Shelby was a major contributor to the formulation of the NTSC Signal Specification through his endless work serving as chairman and member of the many NTSC and RETMA committees. As was stated by one of Mr. Shelby's very close colleagues, "I know of no one who labored longer or with more good will in the cause of television broadcasting than did Bob."

Samuel L. Warner Memorial

William Mueller, chairman of the Samuel L. Warner Memorial Award Committee, presented the award to C. C. Davis and read the following citation:

Mr. Davis joined the staff of Electrical Research Products Inc. in 1928 as a theater installation engineer. He was transferred in 1935 to the Apparatus Design Division of the same company. In World War II he served as a field engineer in the Radar Field Service Organization of the Western Electric Co. Since 1945 he has been continuously engaged in developments and improvements of sound recording and reproducing mechanisms. As part of this sound program he developed in 1945 an improved film transport mechanism now widely used in sprocket-type studio equipment, and which is universally referred to as the Davis Drive. He received an Academy Award for this development in 1948. He later extended this same principle to professional disk recording drives. In 1950 Mr. Davis developed a multitrack magnetic head with extremely low crosstalk. He has received ten patents in the United States and numerous others in foreign countries covering his inventions in the field of sound recording.

Herbert T. Kalmus Gold Medal

The first recipient of the new SMPTE Award, the Herbert T. Kalmus Gold Medal, Dr. Wesley T. Hanson, Jr., was introduced by William F. Kelley who read the following citation in the absence of Dr. Deane R. White, Chairman of the Committee:

The Society of Motion Picture and Television Engineers has selected Dr. Wesley T. Hanson, Jr., of the Eastman Kodak Company as the recipient of its Kalmus Award for 1956. It is the purpose of this award to do honor to the recipient and to the Society by recognizing outstanding contributions in the development of color films, processes, techniques or equipment useful in making color motion pictures for theater or television use.

Dr. Hanson was selected to be the first recipient of this award because of the contributions he has made in connection with materials for use in professional color motion-picture photography. While it is to be understood that such success as these films have attained in the field of color

motion-picture photography is the result of important contributions, inventions and discoveries by a considerable group of people, Dr. Hanson has personally been responsible for several of the basic ideas and concepts upon which the production of Eastman Color Negative films, Eastman Color Internegative films and Eastman Color Print films are based. His contributions have been numerous and have extended over a period of several years.

His invention of the use of colored couplers appears as outstanding in its importance; his analysis of the photographic characteristics and color requirements for the group of films to be used in professional color motion-picture photography has been very significant in their evolution; his contribution to the processing of such colored films has been of definite importance. Dr. Hanson also made a contribution through his perception in the selection of ideas which were presented by others during the development stage and his judgment in the use of these ideas.

Dr. W. T. Hanson, Jr., is now head of the Color Photography Division of the Kodak Research Laboratory in Rochester, N. Y. He entered the service of the Eastman Kodak Company in 1934 after he received the Ph.D. degree in chemistry. While with the company he has devoted years of effort to color photography, though those efforts were interrupted during World War II by assignment to another post of responsibility.

SMPTE Elections

Early in August ballots were circulated to the 2300 voting members of the Society to elect Society and Section Officers for terms beginning January 1, 1957. Section ballots were counted by the section boards of managers prior to the 80th Convention and Society ballots were counted by a panel of tellers under M. A. Hankins on October 6 in Los Angeles.

The results of the Society election were announced by President John G. Frayne at the Get-Together Luncheon which officially opened the Convention. Dr. Frayne introduced the new officers and Governors who were elected for two-year terms. Barton Kreuzer, Director of Product Planning for the Radio Corporation of America, was elected President to succeed Dr. Frayne; and Norwood L. Simmons, Chief Engineer, West Coast Division of the Eastman Kodak Co. Motion Picture Film Dept., was elected Executive Vice-President. Other elected officers are Glenn E. Matthews, Eastman Kodak Co., Editorial Vice-President; G. Carleton Hunt, General Film Laboratories, Convention Vice-President; and Wilton R. Holm, E. I. du Pont de Nemours & Co., Secretary.

Six new Governors were also selected, including two each from the East Coast, Central and West Coast Areas. They are: Howard A. Chinn of CBS; Gerald G. Graham of the National Film Board of Canada; James L. Wassell of Bell & Howell; W. Wallace Lozier, National Carbon Co.; Edwin W. Templin, Westrex Corp.; and Ub Iwerks, Walt Disney Productions. Mr. Graham is the first member to be elected to the Board from outside the United States.

The following Section Chairmen and Secretary-Treasurers were elected for one-year terms and Members of the Boards of Managers for two years, except where otherwise indicated:

Atlanta Section
Chairman, Charles W. Wood
Secretary-Treasurer, Earl R. Ruckdeschel
Managers 1957–58, Charles D. Beeland, Jr.
C. F. Daugherty
L. H. Kelley
Managers 1957, B. M. Loden
C. Louie Strickland
Frank H. Willard, Jr.

Chicago Section
Chairman, Kenneth M. Mason
Secretary-Treasurer, Howard H. Brauer
Managers 1957–58, James A. Kellock
Frank H. Riffle
Ralph J. Sherry

Dallas-Ft. Worth Section
Chairman, Bruce S. Jamieson
Secretary-Treasurer, Roddy K. Keitz
Managers 1957–58, Jerry A. Dickinson
Merl C. Hartung
Bruce Howard
Managers 1957, Jim Webb Cooper
Hervey Gardenhire
Erwin J. Pattist

Los Angeles Section
Chairman, John W. DuVall
Secretary-Treasurer, Robert G. Hufford
Managers 1957–58, Lester H. Bowman
Louis H. Mesenkop
Harlan L. Baumbach

New York Section
Chairman, George H. Gordon
Secretary-Treasurer, Burton F. Perry
Managers 1957–58, Fenner G. Headley
Robert C. Rheineck
George R. Tingley
Manager 1957, Edward P. Ancona, Jr.

Rochester Section
Chairman, W. I. Kisner
Secretary-Treasurer, A. E. Neumer
Managers 1957–58, Harold Jones
R. E. Putman
R. J. Ross
Managers 1957, J. S. Chandler
Sheldon Holland

San Francisco Section
Chairman, R. A. Isberg
Secretary-Treasurer, Werner Ruhl
Managers 1957–58, Lee Berryhill
W. E. Evans
W. A. Palmer
Managers 1957, Walter Ball
Harry Jacobs
Ross Snyder

Washington, D.C., Section
Chairman, Keith B. Lewis
Secretary-Treasurer, James A. Moses
Managers 1957–58, James A. Barker
Nathan D. Golden
Howland Pike
Managers 1957, Philip M. Cowett
Watson P. Dutton
Jack C. Greenfield

section reports

The Rochester, N.Y. Section met September 14 at the Dryden Theater, Eastman House, Rochester, N.Y., with an attendance of 85. Emery Huse, Manager, West Coast Division of Eastman Kodak Motion-Picture Film Dept., spoke on "Thirty Years of Cinematographic History." Mr. Huse, a Past-President of SMPTE, was introduced by another Past-President, Donald Hyndman. In his talk, Mr. Huse outlined the progress of black-and-white films from the first orthochromatic materials through the introduction of panchromatic film to the many specialized types used today. The progress in sensitometric and chemical process control and the advances in lighting from the original available light photography through the application of tungsten and arclights were also reviewed.

Mr. Huse also presented a demonstration of some of the earliest black-and-white motion pictures. The films were copied from paper prints made about 1900 and now stored in the Library of Congress. He then discussed the development of color films, starting with some of the original color materials in use as early as 1920 and continuing through the color negative and print films now in use. A demonstration of this progress was presented in the form of a collection of original samples of most of the important types of color materials used throughout this period. Mr. Huse concluded his talk by presenting a description, illustrated by slides, of each of the large screen systems now being used.—*G. T. Negus*, Secretary-Treasurer, Rochester Section, c/o Color Technology Div., Eastman Kodak Co., Kodak Park Works, Rochester 4, N.Y.

The Chicago Section met September 25 in the Prudential Building, Chicago, with an attendance of 40. A paper by A. C. Mueller and W. E. Delhorbe, Bell & Howell Co., "A Rapid Acting Continuous Contact Printer for Additive Color Motion-Picture Printing," was read by Mr. Mueller. Through use of appropriate dichroic mirrors the light from an incandescent lamp is divided into red, green and blue beams. The printing intensity of each beam is controlled by a rotatable vane whose position is predetermined by a master program tape. A response time of less than 20 milliseconds for a complete change from minimum to maximum light is achieved. A manual electronic trimming control is provided to compensate for emulsion variations in print stock.—*H. H. Brauer*, Secretary-Treasurer, c/o Bell & Howell, 7100 McCormick Rd., Chicago 45.

The Los Angeles Section met September 18 in the Vine Street Studio of the American Broadcasting Co., Hollywood. An audience of 150 members and guests heard an address on "People, Things and the Engineer" by James F. Gordon, Chief Development Engineer, Helipot Corp. Theodore Grenier, Chief Engineer, Western Division, American Broadcasting Co., spoke on "Television Tackles the Political Convention," and Walter Bach, Vice-President, Berndt-Bach, Inc., spoke on "Magnetic 16mm Single-System Sound-on-Film Recording Camera Equipment."

The theme of Mr. Gordon's illustrated talk was the responsibility of the engineer to society. Mr. Gordon implied that engineers were generally machine-minded and inclined to expect the same type of performance from human beings that they were accustomed to from machines. A recognition of human values and a realistic approach to problems involving human beings would increase the engineer's effectiveness within society, the speaker indicated.

Mr. Grenier described and illustrated the coverage at the recent political convention in San Francisco. He described many of the details that were necessary in the giant equipment move from the convention. Emphasis was placed on the ABC facilities that were used in covering all phases of the convention including the various pickup points that were used in San Francisco.

Mr. Bach described the new single-system 16mm camera for simultaneously recording a high-fidelity magnetic 16mm soundtrack lip-synchronized with an optical picture in color or black-and-white (see the technical pages of this issue of the *Journal*). A color film demonstrating the operation of the camera and several high-quality recordings was screened and enthusiastically received by the audience.—*John W. DuVall*, Secretary-Treasurer, c/o E. I. du Pont de Nemours & Co., 7051 Santa Monica Blvd., Hollywood 38.

Education, Industry News

Loren L. Ryder has resigned from the post of Head of the Sound Department of Paramount Pictures Corp., to enable him to devote more time to his firm of Ryder Sound Services, Inc., to Magnetic Sales Corp., and to Ryder Editorial Services, Inc., a newly formed corporation. He is being retained by Paramount in the capacity of technical consultant to Y. Frank Freeman. Mr. Ryder has been with Paramount since 1929 when he became Head of Sound Research and Development. In 1936 he became Head of the Sound Department and in 1951 was appointed to the post of Head of Engineering and Recording.

Clarence L. A. Wynd has been elected a Vice-President of Eastman Kodak Co. He is also Assistant General Manager of the Company's largest plant, the Kodak Park Works, Rochester, N.Y., and a director of the Eastman Gelatine Corp., Peabody, Mass., a Kodak subsidiary. He is a member of the Society and also belongs to the American Chemical Society, American Institute of Chemical Engineers and other professional organizations.

Sylvania Electric Products Inc. has added two service laboratories to its Southern California distribution center at 6505 East Gayhart St., Los Angeles. The laboratories occupy a 5-acre site at the former Vail Air Field. The new facilities, the Receiving Tube Engineering Laboratory and the Special Lamps Application Laboratory are designed for research and developmental work on special problems. The Receiving Tube Laboratory is devoted to engineering field service in electronics, with emphasis on radio and television quality and engineering problems of application. The Special Lamps Laboratory will service and develop special applications of the firm's lamp products on the West Coast, particularly in the motion-picture and defense industries.

Rudy Bretz, one of television industry's top programming and production consultants, has been appointed to the theater arts faculty at the University of California at Los Angeles. He has served as consultant for TV stations in the United States, Canada, Europe and Australia. He was associated with the Columbia Broadcasting System for 9 years and in 1949 prepared a report, at the request of the Rockefeller Foundation, on the television industry as a cultural force in America. Prior to his present assignment he was consultant for the Australian Broadcast Commission. While in Australia he designed and equipped a motion-picture studio for the Artransa Company (p. 355 of the June 1956 *Journal*).

Byron Roudabush, President of Byron, Inc., 1226 Wisconsin Ave., Washington, D.C., is again this year providing scholarships for two engineering students at his alma mater, Lehigh University. The scholarship is awarded each year to a Junior student in any branch of engineering, and the aid continues through his Senior year.

The Curtis W. McGraw Research Award for achievement in engineering research will be granted for the first time in June 1957. The award, which includes a cash prize of $1000, will thereafter be given annually to a young faculty member of a college or university for "original contribution in engineering research," who has also "demonstrated high potential for future leadership." The award is in memory of the late Curtis W. McGraw and is administered by the American Society for Engineering Education through the Engineering College Research Council. Chairman of the selection committee is Dean James R. Cudworth of the University of Alabama. Nominations for the 1957 award may be sent to Dean Cudworth before February 1, 1957.

The Motion Picture Industry Credit Group recently added to its membership rolls the names of Criterion Film Laboratories, Inc., and Comprehensive Service Corp., both of New York. The group elected Joseph A. Tanney of S.O.S. Cinema Supply Co., Chairman; and Kern Moyse of Peerless Film Laboratories, Vice-Chairman. Unexpired terms of office until May 1, 1957, resulted from the resignation of Samuel L. Silverman of Precision Film Laboratories.

Obituaries

Dr. Alexander Ernemann died October 14 in Stuttgart, Germany, at the age of 80. His death occurred five days after he had been awarded Honorary Membership in the Society.

Among Dr. Ernemann's contributions to cinematography was the development of one of the first motion-picture projectors. He developed the first projector with enclosed gears and full lubrication and was also the first to use air and water for cooling. He joined his father's firm in 1904 and in 1910 became a managing director of Ernemann Ag. In 1925 he presented the first German sound projector in commercial cooperation with Krupp, of Essen. He joined the firm of Zeiss Ikon Ag. as managing director at the time of its organization in 1926. Through the years he continued to design and develop projectors, beginning in 1909 with the projector designated as Ernemann I. The last projector designed by him is the Ernemann X.

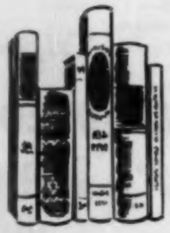
Honors accorded him during the 52 years he devoted to the improvement of cinematography included the Messter Medal, the highest honor of the German Cinematographic Society. He was also awarded the titles of Honorary Senator of the Technical Colleges of Stuttgart and Honorary Doctor of Philosophy by the University of Kiel. A biographical note and picture of Dr. Ernemann were published in the January 1955 *Journal*, p. 40.

The address delivered by Loren L. Ryder October 9 on the occasion of bestowing the Society's Honorary Membership upon Dr. Ernemann closed with the words, "Dr. Ernemann's achievements will live forever and we of the Society are happy that we can honor him today."

Edward H. Wolk, 63, died suddenly August 23. He had been actively engaged in the motion-picture industry for more than 35 years, and was one of the founders of the Chicago Cinema Equipment Co. In 1932 he organized the Edward H. Wolk Co., now located at 1241 S. Wabash Ave., Chicago.

Membership Certificates (Active and Associate members only). Attractive hand-engrossed certificates, suitable for framing for display in offices or homes, may be obtained by writing to Society headquarters, at 55 West 42d St., New York 36, Price: **$2.50.**

books reviewed



Transactions of The 2nd International Congress of High-Speed Photography and Cinematography

Edited by Pierre Naslin and Jean Vivié. Published (1956) by Dunod, 92 Rue Bonaparte, Paris VI. i-xxviii + 455 pp., Profusely illus. incl. 5 color plates, $8\frac{1}{4} \times 11\frac{1}{4}$ in. Price 6,000 fr. Copies available from SMPTE headquarters, $17.25.

The proceedings of the 2nd International Congress on High Speed Photography held in Paris in September 1954 are compiled in this sizable book which features translations of many of the papers in German, French and English. The book is printed in large and generous format and includes numerous illustrations and graphs. A total of 68 papers are covered, classified into 14 parts as follows: Flashlamps and Flash Cameras (10 papers), Radiography (2 papers), High-Speed Shutters (3 papers), Mechanical-Optical Cameras (9 papers), Image-Dissection Cameras (3 papers), Sensitive Surfaces—"Emulsions" (2 papers) Lighting (2 papers), Schlieren and Interferometry (7 papers), Biology (4 papers), Metallurgy and Mechanical Engineering (3 papers), and Atomization — "Fluid Sprays" (4 papers).

In comparing this publication with others on the subject, pubiished in the past, it is noted that the quality of the papers is particularly high and that the material covered is largely new rather than repetition of earlier work. Because of the translations provided, this book should find ready acceptance in all parts of the world. Particular care has been given to proper translation of the many technical phrases which are involved as well as to the papers in general. Discussion where given on a paper has been included.

No attempt has been made to restrict the illustrations and this adds much to the value of the publication. Many of these are also in color.

The papers have been carefully arranged to achieve reading ease regardless of the language concerned. The titles, forewords, and all captions of illustrations are given in all three languages. A good quality, hard finish paper has been used and the binding is well done. This publication seems to be well worth the price. It covers a sizable part of the current equipment and techniques of high-speed photography in a fashion to recommend it for anyone working in this field.—*Richard O. Painter*, General Motors Proving Ground, Milford, Mich.

Reference Data for Radio Engineers, 4th ed.

Edited by H. P. Westman. Published (1956) by International Telephone and Telegraph Corp., Publication Dept., 67 Broad St., New York 4. 1150 pp. Illus. Tables. $5\frac{3}{4} \times 8\frac{3}{4}$. Price $6.00.

In this volume, contents of the Third Edition have been brought up to date and expanded where developments required further treatment. New material has been added on such subjects as modern network design of filters, magnetic amplifiers, feedback control systems, semiconductors and transistors, scattering matrixes, digital computors, nuclear physics, information theory, and probability and statistics.

The book is primarily a compilation of equations, graphs, tables and similar data that are frequently needed in general radio engineering and in college instruction. Prepared by engineers who are specialists in the various subjects covered in the book, it affords a convenient source of data.

current literature

The Editors present for convenient reference a list of articles dealing with subjects cognate to motion-picture engineering published in a number of selected journals. Photostatic or microfilm copies of articles in magazines that are available may be obtained from The Library of Congress, Washington, D.C., or from the New York Public Library, New York, N.Y., at prevailing rates.

American Cinematographer vol. 37, July, 1956

Sub-Zero Camera Operation (p. 414) *W. Hoch*

A Portable, Automatic Interval Timer (p. 422) *P. F. Ruckert*

The Depth of Field of Camera Lenses (p. 424)

vol. 37, August, 1956

Starting the New Assignment (p. 473) *W. Strenge*

Harnessing Sunlight with Reflectors (p. 474) *A. Rowan*

Location Camera Carriers (p. 476) *F. Foster*

Shooting an Industrial with Ansco's New, Fast Color Film (p. 482) *J. Mitchell*

3-Perforation Film Frame Spacing Proposed (p. 486)

British Kinematography vol. 28, June 1956

Equipment Used for the New Techniques in Film Production (p. 185)

Kazimierz Proszynski (1875–1945) *B. Orna* and *E. Orna*

vol. 29, July, 1956

Handling the New Presentation Techniques (p. 10) *R. E. Pulman*

The Building of the Independent Television News Service (p. 23) *P. H. Dorté*

International Photographer vol. 28, July, 1956

Laboratory Processing of 35mm Black and White Negative (p. 5) *W. R. Greene*

The Cine Kodak Special (p. 7) *R. W. Sumner*

International Projectionist vol. 31, July, 1956

A Common Sense Approach to Screens, Apertures and Aspect Ratios (p. 7) *R. A. Mitchell*

Curved Gate for Simplex Projectors (p. 13) *H. Barnett*

vol. 31, August, 1956

Magnetic Tracks on Release Prints (p. 7) *R. A. Mitchell*

More About Pictures on Tape (p. 10) *R. Snyder*

A Pre-Selector Device for Sound Changeover (p. 12) *J. Holt*

Muted Colors in "Moby Dick" (p. 15) *N. Wasserman*

Kino-Technik vol. 10, August, 1956

Mikrofone und Lautsprecher—Endpunkte bei der Tonübertragung (p. 284)

Die technische Entwicklung bis zum modernen Mikrofon (p. 288)

Geeignete Mikrofon-Typen für das Tonfilm-Studio (p. 291)

Betrachtungen zum Stand der Lautsprechertechnik (p. 299)

Ein Ringschmalfilm-Projektor mit Filmwechselschieber (p. 301)

Schmalfilm-Stillstandprojektion für besondere Zwecke (p. 302)

Bessere Schirmbildschärfe durch neuartige Filmführung (p. 306)

New Members

The following members have been added to the Society's rolls since those last published. The designations of grades are the same as those used in the 1956 Membership Directory.

Active (M) Associate (A) Student (S)

This is the fifth list of New Members supplementing the April Journal, Part II, Directory.

Allen, Charles Hall, Mot-Pic Sound Specialist. Mail: 1350 Motion Picture Sqdn., USAF, Wright Patterson Air Force Base, Dayton, Ohio. (A)

Biglow, Park, TV Eng., KNXT, CBS. Mail: 2272 Cove Ave., Los Angeles 39. (A)

Briggs, Stephen F., Manager, Out-Board Motor Corp. Mail: Naples, Fla. (A)

Chen, Ying Chien, Branch Manager & Depot Engineer. Eastern Sales & Engineering Co., 10 Queen's Rd. Central, Hong Kong, China. (A)

Chesrow, Richard A., 16mm Producer & Photographer, Free-Lance, 177 N. State St., Chicago. (M)

Conway, Gerald J., Negative Developer, General Film Lab. Mail: 11453 Cumpston Ave., N. Hollywood. (A)

Currey, Edward William, Long Island Agr. & Tech. Inst. Mail: 147-41 38 Ave., Flushing, N.Y. (S)

Damron, Sidney S., TV Eng. (A) American Broadcasting Co. Mail: 50 Berens Dr., Kentfield, Calif. (A)

Dee, Joseph Anthony, Manager, Brooks Cameras. Mail: 10 Forest Side Ave., San Francisco. (A)

Deibler, Melvin Edward, Long Island Agr. & Tech. Inst., Melville Rd., Farmingdale, N.Y. (S)

Diener, Richard W., Long Island Agricultural & Tech. Inst. Mail: Adamsville Rd., Elkhart, Ind. (S)

Diltz, Thomas Richard, Photog., Texas Game & Fish Commission, Walton Bldg., Austin, Tex. (A)

Eilers, Carl G., Elect. Eng., Zenith Radio Corp. Mail: 104 W. Maple St., Fairbury, Ill. (M)

Enkelmann, Walter, Eng. Unicorn Engineering Corp., 1040 N. McCadden Pl., Hollywood. (A)

Feingold, Morris, Mot.-Pic. Soundman, Free-Lance, ISTSE Local 52, 1466 Watson Ave., Bronx 72, N.Y. (A)

Fleischman, Ben George, Free-Lance. Ben Fleischman Photography, 107 SE 16 Ave., Portland 14, Oregon. (A)

Gast, John P., Chief, Photographic Branch, Film Distr., Dept. of Defense. Mail: 1Cheverly Cir., Cheverly, Md. (A)

Gordon, James Christopherson, Art Director, Animator, Holland-Wegman Productions. Mail: 207 Mineral Spring Rd., Buffalo 10, N.Y. (A)

Gropper, Lawrence Herbert, Long Island Agr. & Tech. Inst. Mail: 69-11 166 St., Flushing 65, N.Y. (S)

Hall, Bryan L., Film Lab. Techn., General Film Labs. Mail: 10422 Califa St., N. Hollywood. (A)

Hansen, Roy V., Mot.-Pic. Projectionist. Willmar Amusement Co., Chief Drive-In, Box 2, Willmar, Minn. (A)

Husslein, Fred, Long Island Agr. & Tech. Inst. Mail: 8505 91 St., Woodhaven 21, N.Y. (S)

Jones, James Burdean, Mot.-Pic. Equipment Supply Officer, U.S. Information Agency. Mail: Westbriar Ct., Rt. 4, Box 424, Vienna, Va. (A)

Kaneko, George, Techn., Eastman Kodak Co. Mail: 113 Denenchofu 3 Chome, Ota-Ku, Tokyo, Japan. (A)

Kang, Young Ok, Radio & TV Eng., Television Corp. of American. Mail: 343 Iolani Ave., Honolulu, T.H. (A)

Kasparovics, Maris, Long Island Agr. & Tech. Inst. Mail: 244 Floral Pkwy., Floral Park, N.Y. (S)

Keating, Stephen Edward, Negative Cleaner, Capital Film Lab. Mail: 1728 Queen's La., Arlington, Va. (A)

Keehn, Neal G., Vice-Pres., The Calvin Co., 1105 Truman Rd., Kansas City, Mo. (M)

Kellogg, Brandon, Recording Eng., Magnetic Recorders Co. Mail: 1853½ N. Highland Ave., Los Angeles 28. (A)

Kemeni, Oswaldo Cruz, Rex Filme S.A., R. Jacequai 673, Sao Paulo, Brazil. (A)

Koskovolis, Spiro Louis, Film Supervisor, Dancer-Fitzgerald-Sample, Inc. Mail: 308 W. 42 St., New York. (A)

Lemmert, Walter A., USAF. Mail: 3312 W. 61 St., Chicago 29. (A)

Levine, Abraham L., Chief Eng., Color Research Laboratories, 321 S. Twelfth St., Philadelphia 7. (A)

Marlow, James Joseph, TV Broadcast Eng., USASC. Mail: 1500 Bergen Blvd., Fort Lee, N.J. (A)

Martin, Joel F., Printer, General Film Labs. Mail: 6851 Belmar Ave., Reseda, Calif. (A)

Mathews, Glen Paul, Cameraman & Production Supvr., Remington Rand, Visual Aid Dept., 315 Fourth Ave., New York 10. (A)

Massman, Charles Edward, Sales Eng., Sylvania Electric Products, 2001 Cornell Ave., Melrose Park, Ill. (A)

Mayer, Pauline, Mot.-Pic. Lab. Techn., Jamieson Film Co. Mail: 2631 White Rock Rd., Dallas, Tex. (A)

McBride, J. Donald, Recording Eng., RCA Victor Co., Ltd., 225 Mutual St., Toronto, Ont., Can. (A)

Moore, J. Leo, Pres., Southwest Drug Co., Inc. Mail: 611 Cherry St., Jackson, Miss. (M)

Morris, Walter John, State Univ. N.Y. Mail: 91-47 91 St., Woodhaven 21, N.Y. (S)

Nairn, John William, Elec. & Projectionist, Morwell Cinema. Mail: Box 153 Morwell, Victoria, Australia. (A)

Newman, Seymour, Long Island Agr. & Tech. Inst. Mail: 2082 Crotona Pkwy., New York 60. (S)

Oliver, William Ernest, Senior Photographic Officer. British Overseas Airways Corp., HQ Building Block O, Second Fl., London Airport, Hounslow, Middlesex, Eng. (A)

Peake, Hayden B., Techn., Eastman Kodak Co. Mail: 120 Saratoga Ave., Rochester, N.Y. (A)

Petersen, Clyde M., General Manager, Nevada Film Production, Inc., 770 E. Fifth St., Reno, Nev. (A)

Pullis, G. William, Long Island Agr. & Tech. Inst. Mail: Oak Ave., Centereach, N.Y. (S)

Redd, Raymond G., Lab. Manager, Jamieson Film Co. Mail: Box 308, Wilmer, Tex. (A)

Revalee, Guy Chaney, Animated Motion Pictures, UPA Pictures, Inc. Mail: 432 N. Reese Pl., Burbank, Calif. (A)

Roschke, Erwin M., TV Eng., Zenith Radio Corp., 6001 W. Dickens, Chicago 39. (M)

Sanford, John L., Long Island Agr. & Tech. Inst. Mail: 87 New St., E. Islip, N.Y. (S)

Shifreen, Victor, Photographer, Alfred C. Glassell, Jr., 818 First City National Bank Bldg., Houston, Tex. (A)

Siebert, Donald Charles, Long Island Agr. & Tech. Inst. Mail: 486 N. Ocean Ave., Patchogue, N.Y. (S)

Slaughter, Lee D., Slaughter Photo Service, 2622 Lebanon St., El Paso, Tex. (A)

Suli, Robert John, Long Island Agr. & Tech. Inst. Mail: R.F.D. Ocean Ave., Ronkonkoma, N.Y. (S)

Talarico, Samuel Charles, Projectionist, Walter Reade Theatres. Mail: 57 Pemberton Ave., Oceanport, N.J. (A)

Thomas, Lafayette E., Cameraman-Projectionist, Sky-Dronie Theatre Corp. Mail: 2910 Broad St., Newcastle, Ind. (A)

Tobin, Ephriam D., Long Island Agr. & Tech. Inst. Mail: S. Pascack Rd., Pearl River, N.Y. (S)

Toukhanian, Hrayr Bedros, Audio-Visual Center, Syracuse University, Syracuse 10, N.Y. (A)

Uebele, Alfred George, Long Island Agr. & Tech. Inst. Mail: 84-12 251 St., Bellerose, N.Y. (S)

Vanderzanden, Ray William, Chemist-Quality Control Eng., Sawyer's, Inc., Box 490, Portland, Oregon. (A)

Watson, Kenneth Albert, Photographer, Gainsborough Commercial, Pedder Bldg. Basement, Hong Kong, China. (A)

Wexler, Haskell, Cinematographer, Free-Lance, Juneberry Rd., Deerfield, Ill. (M)

White, Walter E., Mot-Pic. Projectionist, Cinerama. Mail: 75 Beachmont Dr., San Francisco 27. (A)

Yankura, Eugene S., Long Island Agr. & Tech. Inst. Mail: R.F.D. 1, Broadhollow Rd. & Smith St., Amityville, N.Y. (S)

NBC Cameraman "BILL" HARTIGAN films...

Operation DEEPFREEZE

with AURICON PRO-600 16mm Sound-On-Film Camera!

WILLIAM B. HARTIGAN, NBC'S Television News Cameraman, interviewed on his return from the frozen continent of Antarctica, said he filmed 52,000 feet of Auricon Sound-On-Film in color near the South Pole, with "Operation Deepfreeze."

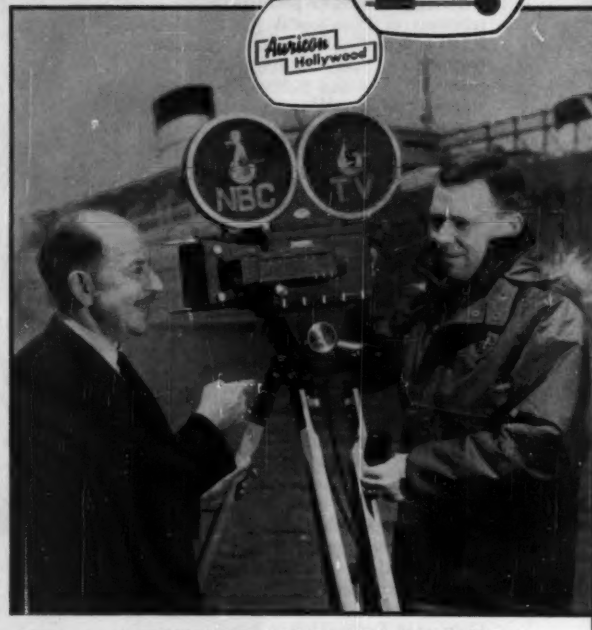
TWENTY-FIVE BELOW ZERO, and blinding 100 mile-per-hour winds were the challenging climatic conditions hurled at Cameraman and Sound-camera on this desolate, ice-covered continent at the bottom of the world.

HARTIGAN'S AURICON SOUND FILMS were the first pictures of any kind to be flown to the waiting press and television news broadcasters, telling of the hazardous life led by courageous explorers on Antarctica.

"SUCCESSFUL PERFORMANCE under rigorous below-zero conditions," is the praise Hartigan gives his "Auricon Pro-600." Even after his Auricon was accidentally submerged in water, the Camera was dried out and operated normally.

AURICON DEPENDABILITY on "Operation Deepfreeze" is another example of how Cameramen all over the world rely on Auricon for professional picture and sound-track in the production of Television Newsreels, as well as Film Commercials, Dramatic Inserts, and local Sound-Film programming.

AURICON CAMERAS are sold with a 30-day money-back guarantee. You must be satisfied! Write for free illustrated Auricon Catalog to BERNDT-BACH, INC., 6946 Romaine Street, Hollywood 38, California. Phone HOllywood 2-0931.



MR. J. A. TANNEY, (left), President of S.O.S. Cinema Supply Corp., New York City, who supplied the Auricon Equipment and Accessories for "Operation Deepfreeze," discusses with NBC's William B. Hartigan the successful below-zero performance of the "Auricon Pro-600" Sound-On-Film Recording Camera.

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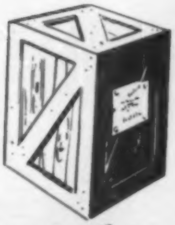


new products

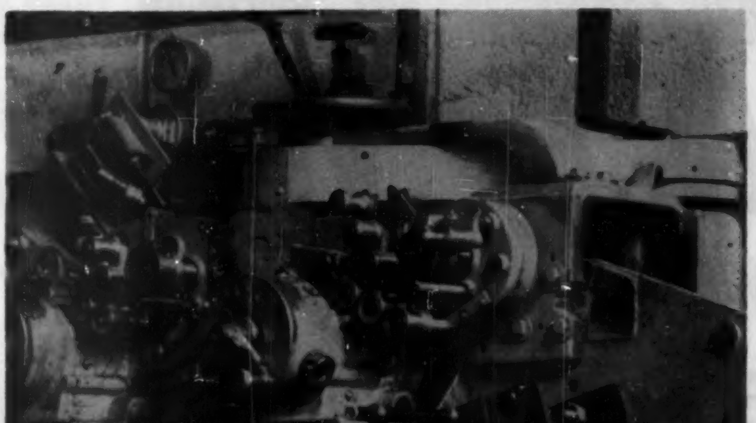
(and developments)

Further information about these items can be obtained direct from the addresses given. As in the case of technical papers, the Society is not responsible for manufacturers' statements, and publication of these items does not constitute endorsement of the products or services.

Cine-Kodak Plus-X Negative Film has been announced by Eastman Kodak Company as a versatile, fast, new 16mm negative film for news, commercial and industrial photographers who make black-and-white motion pictures. With exposure indexes of 80 daylight, 64 tungsten, it is a film suited for general-purpose exterior use and for well-lighted interiors in sports, television and movie news and the audio-visual film fields. The new film is twice as fast as Cine-Kodak Panchromatic Negative Film which it replaces. Cine-Kodak Plus-X Negative Film can be processed in the same solutions as Cine-Kodak Tri-X Negative Film. It is available with one- or two-edge perforations. Spools of 100 and 200 ft are priced at $4.00 and $6.80, respectively.

The Master III is described as "ruggedized," especially by means of a "shock mounting" bearing and spring arrangement incorporated to protect the meter's accurate functioning. The meter, manufactured by the Weston Electrical Instrument Corp., 614 Frelinghuysen Ave., Newark 5, N.J., has a full complement of film emulsion speeds up to 3200. It is reported by its manufacturers to incorporate many of the design techniques used in precision instruments for military use. A 24-page instruction book, prepared to accompany the meter, describes its use for reflected light or for incident light when the Weston Invercone is added. Applications for motion pictures, Polaroid and LVS Numbers are outlined as well as alternate methods according to subject and light and for black-and-white and color. It is priced at $32.50.

A cigar-shaped TV camera called the Peepsqueak measures less than 6 in. in length and $1\frac{7}{8}$ in. in diameter. Its miniature size permits thorough inside inspection of otherwise inaccessible areas. Equipped with 2 sets of spring-loaded guide rollers, it travels through pipes or walls that have an inner diameter of a minimum of $2\frac{3}{8}$ in. and a bending radius of 14 in. The remote-controlled unit contains a miniresistron and a number of subminiature tubes that serve as amplifying elements. A conical mirror accessory may be mounted $\frac{3}{4}$ in. ahead of the lens combination to reflect the image of the inside walls. The image received can be magnified up to 20 times since the focal length of the lens system is $1\frac{1}{4}$ in. The camera is manufactured in West Germany by Grundig Radio-Werke GmbH and is marketed in the United States under the Grundig-Majestic trademark exclusively by Majestic International Corp., 743 N. LaSalle St., Chicago 10.



The Hi-Speed Additive Color Compensating Head, announced by the Fish-Schurman Corp., 70 Portman Rd., New Rochelle, N.Y., is designed with a single 1000-w light source and three electromechanically operated light valves and will provide color changes in 5 msec. Each light valve is controlled by five small solenoids to provide 32 printer steps. The light valve opening may be simply adjusted to compensate for color stock changes without altering the 32-step arrangement. Originally designed to operate with the Bell & Howell Model D, E, and J heads, it is now available to fit other heads.

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Picasso's Head of a Woman courtesy Albert E. Lewin

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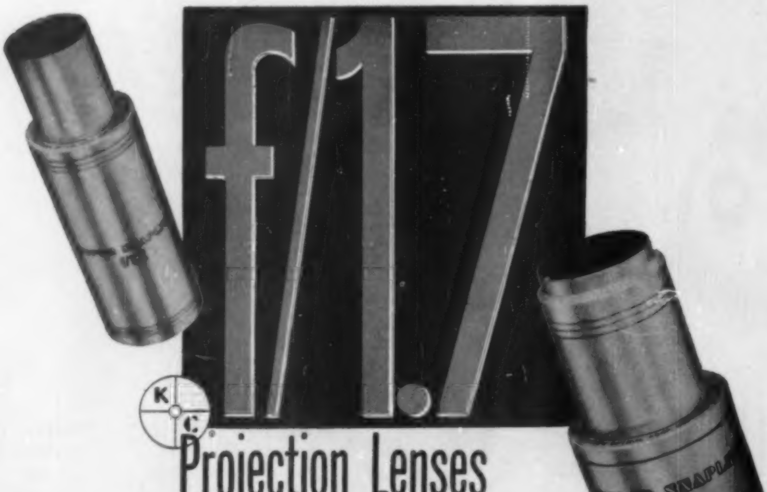

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employment service

These notices are published for the service of the membership and the field. They are inserted three months, at no charge to the member. The Society's address cannot be used for replies.

Positions Wanted

Television Program Assistant. College Graduate, B.S. Business Administration. October graduate from SRT-T.V. School, Programming & Production. Background in music, including both radio and television experience. Also, five years of summer dramatics with both acting and direction experience. Directed fifteen closed-circuit shows and have thorough skill with RCA cameras (black-and-white & color), RCA boom, switchir g units, etc. Available October 15, 1956. Morton Eisgrau, 63 Fremont St., Harrison, N.Y.

Radio-Television Production or Directing Assistant. January graduate Boston Univ. (B.S. Communication Arts). Experienced AM-FM-TV engineer (First Class Radio-Telephone License). Radio production and directing experience. Desird position with radio or TV station specializing in live programming or with TV film organization. Complete resume on request. Louis Maggi, 110 Lonsdale St., Dorchester 24, Mass.

Sound Recordist-Mixer-Editor. 18 years experience as broadcast and recording studio technician, including 2½ years variable area sound film, double system. Moviola editing and cutting. Formal musical education, read long score. Transmission systems design, maintenance and installation. Past 5 years as Technical Director and Production Assistant for network package producer with own facilities. Duties included multiple tape re-recording and editing with responsibility for selection of b.g. music and effects. Administrative. Highly specialized in "trick" audio, producing over 1100 of these shows for ABC-Radio. Some camera experience, own Cine Special. Detailed resume on request. 38 years old, married, stable. Wm. Mahoney, 69 Tokeneke Rd., Darien, Conn.

Television Film Director-Motion Picture Cameraman-Film Editor. Over five years experience in television film operations, now employed, desires connection with organization active in film production. Owns own motion-picture camera and film editing equipment. Active member SMPTE. Single with car, free to travel. Best references. Require thirty days notice to present employer. Frank E. Sherry, 1505 North Summit Ave., Tyler, Texas. Tel. 2-6132.

Positions Available

Physicists, Photo-Optics. For research and development on tasks in metric photography, infrared systems, visibility and related instruments. Location: Northwest Florida or Chicago, Ill. Positions at junior and senior levels. Address replies to: Chicago Midway Laboratories of the University of Chicago, Eglin Air Force Base, Fla.

Top Sales Engineer for projection carbons. Nationwide or territorial. Must have extensive experience in the field and good contacts. Write: Suite 3403, 70 Pine St., New York 5.

Journals Available

These notices are published as a service to expedite disposal and acquisition of out-of-print Journals. Please write direct to the persons and addresses listed.

Recent issues available. Write: F. H. Cole, 144 Via Trieste, Newport Beach, Calif.

Complete set of 64 bound volumes of the Transactions and Journal of the Society, 1916 to 1955 inclusive. Available only as entire lot. Price $500. Write: J. I. Crabtree, 26 Broadway, Rochester 7, N.Y.

Jan. 1930 through Dec. 1937; Journal SMPE issues; and Jan. 1930 through Dec. 1935, bound volumes of SMPE Journal; SMPE Transactions: Apr. 1919:8, May 1920:10; May 1922:13; Oct. 1922:15; May 1925:21; Oct. 1925:24; Apr. 1927: 30; Sept. 1927:32; Apr. 1928:33; Sept. 1928:36; SMPE Membership Listings: 1928, 1930, 1938; SMPE Index and Authors: 1930–1935; SMPE Miscellaneous: ASA Z22—1930; Dim Stab of M.P. Films 1934; ASA Z22—1935; High Intensity Lamps—1935; Program Spring Convention Apr. 26, 1939. Write John Faber, 5 Edgewater Drive, Denville, N. J. Phone Rockaway 9-2623M.

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Jan.–Dec. 1950; Jan., Feb., Apr.–Dec. 1951; Jan.–Mar. 1952. Also available are vols. 6 and 7 of the The Television Society (British) covering the period Jan. 1950 through Sept. 1955. Write: Andrew N. McClellan, 65 Hillside Drive, Toronto 6, Ont., Canada.

Jan. 1939 to date. Write: Fred A. Manley, 127 Thistledown Drive, Rochester 17, N. Y.

July–Dec. 1952, Jan.–Nov. 1953, Jan.–Apr., June–July, Sept.–Dec. 1954, Jan.–Mar. 1955. Write: Omar Marcus, 1925 Cadiz St., New Orleans 15, La.

Dec. 1946, Feb.–Dec. 1947, 1948–1955 complete. All copies in perfect condition; for sale as entire lot only. Write: Joseph W. MacDonald, 2414 Sullivant Ave., Columbus 4, Ohio

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Advertisers

Meeting Calendar

American Institute of Chemical Engineers, Dec. 9–12, Hotel Statler, Boston, Mass.
American Association for the Advancement of Science, Dec. 26–31, Statler Hotel, New York.
Symposium on Communication Theory and Antenna Design, sponsored by Air Force Cambridge Research Center and Boston University, Jan. 9–11, 1957, Boston University, Boston, Mass.
3rd National Symposium on Reliability and Quality Control in Electronics, Jan. 14–16, 1957, Hotel Statler, Washington, D. C.
American Institute of Electrical Engineers, Winter General Meeting, Jan. 21–25, 1957, Hotel Statler, New York.
Audio Engineering Society, West Coast Convention, Feb. 7, 8, 1957, Ambassador Hotel, Los Angeles.
Optical Society of America, Mar. 7–9, 1957, Statler Hotel, New York.
Radio Engineering Show and IRE National Convention, Mar. 18–21, 1957, New York Coliseum, New York.
American Physical Society, Mar. 21–23, 1957, U. of Pennsylvania, Philadelphia, Pa.
American Chemical Society, Apr. 7–12, 1957, Miami, Fla.
National Academy of Sciences, Apr. 22–24, 1957, Washington, D. C.
American Physical Society, Apr. 25–27, 1957, Washington, D. C.
American Society for Testing Materials, June 16–21, 1957, Chalfonte-Haddon Hall, Atlantic City, N. J.
American Institute of Electrical Engineers, Summer General Meeting, June 24–28, 1957, Montreal, Que.
81st Semiannual Convention of the SMPTE, including Equipment Exhibit, Apr. 29–May 3, 1957, Shoreham Hotel, Washington, D. C.
82nd Semiannual Convention of the SMPTE, including Equipment Exhibit, Oct. 4–9, 1957, Philadelphia-Sheraton, Philadelphia.
83rd Semiannual Convention of the SMPTE, including Equipment Exhibit, April 21–26, 1958, Ambassador Hotel, Los Angeles.
84th Semiannual Convention of the SMPTE, Oct. 20–24, 1958, Sheraton-Cadillac, Detroit.
85th Semiannual Convention of the SMPTE, including International Equipment Exhibit, May 4–8, 1959, Fontainebleau, Miami Beach.
86th Semiannual Convention of the SMPTE, including Equipment Exhibit, Oct. 6–10, 1959, Statler, New York.

SMPTE Officers and Committees: The rosters of the Officers of the Society, its Sections Subsections and Chapters, and of the Committee Chairmen and Members were published in the April 1956 Journal.

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